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Environmental Assessment

Waste Treatment Facility

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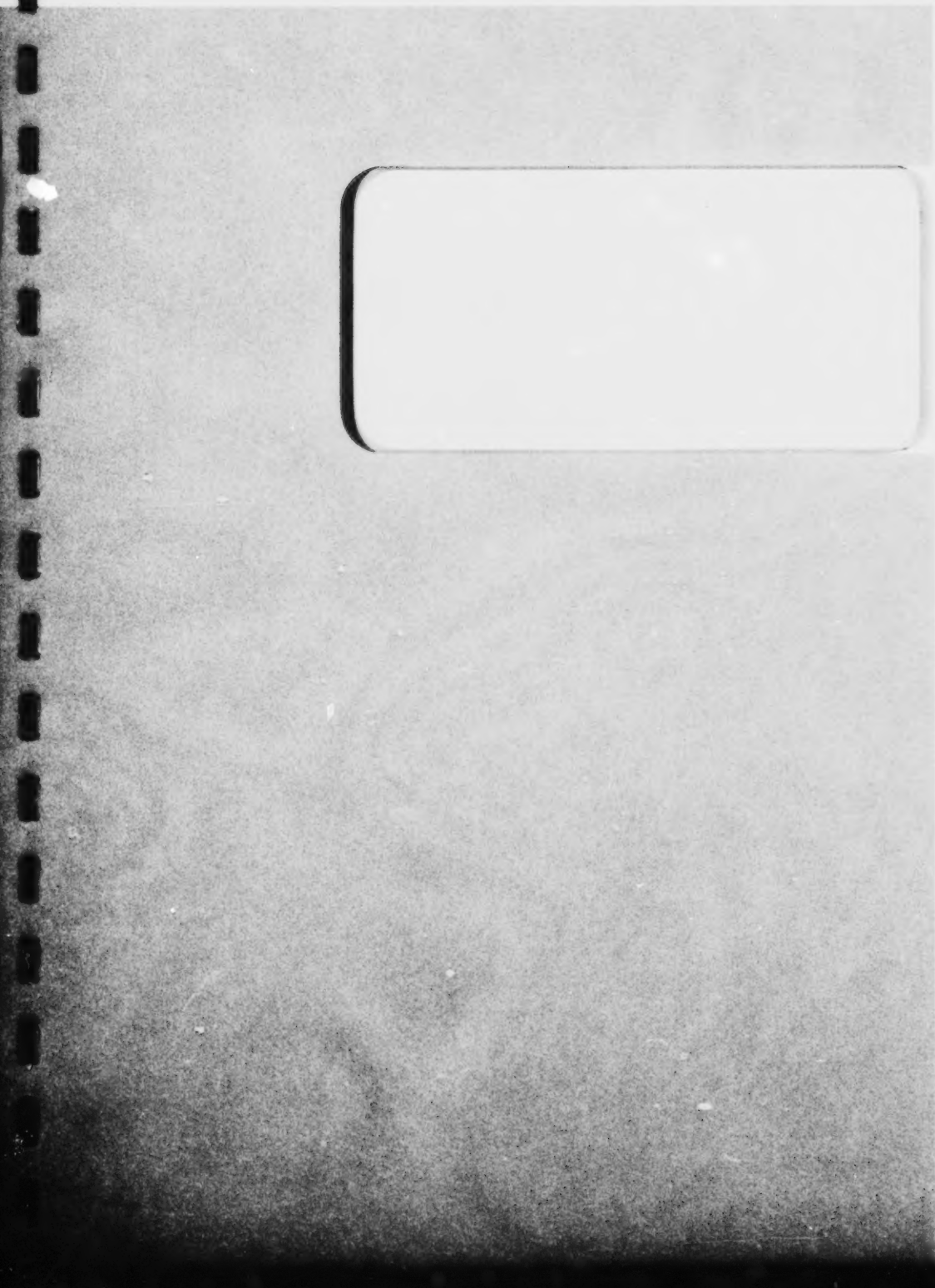

MARKET ASSESSMENT PROGRAM
SURVEY OF 1000 INDUSTRIAL ESTABLISHMENTS

Prepared for
The Ontario Waste Management Corporation

By

Canviro Consultants Ltd.
Kitchener, Ontario

March, 1985

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March 7, 1985

Mr. Bill Lightowlers
Head, Marketing and Sales
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Toronto, Ontario
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Dear Mr. Lightowlers:

We are pleased to submit the final report entitled "Marketing Assessment Program Survey of 1000 Industrial Establishments".

We appreciate the opportunity of working for the Corporation on this project.

Yours very truly,

CANVIRO CONSULTANTS LTD.

Earl E. Shannon, Ph.D., P.Eng.
EES/vy
Encl.

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EXECUTIVE SUMMARY

PURPOSE OF THE REPORT

The purpose of this report is to present the results of a marketing and quantities survey of special wastes for a sample of 1000 Ontario manufacturing establishments. The objectives of the project which was carried out for the Ontario Waste Management Corporation (OWMC) were to:

1) Establish a marketing and waste quantities data base to assist OWMC in the planning of treatment and disposal facilities and waste management programs.

2) Develop, by utilizing a standard statistical sampling and extrapolation procedure, estimates of the total quantities of special wastes currently generated in Ontario.

SCOPE AND METHOD

In order to develop estimates of waste quantities, which are relatively independent of previous studies, this survey utilized a statistical market survey approach.

The sample group was selected from Ontario manufacturing establishments utilizing a stratified random sampling technique. In order to provide initial direction for the total survey and to meet immediate planning requirements, the initial sample size was limited to 500 manufacturing establishments. The 500 industrial establishments were selected from 96 strata defined by 49, 2 and 3 digit United States Standard Industrial Classifications (SICs) and two production employee size ranges (ie. $\leq$10 and >10 production employees).

Upon completion of the 500 establishment survey, it was determined that the data base should be supplemented by surveying an additional 500 establishments, thereby bringing the total survey size to a nominal size of 1000. (Actual number of establishments surveyed was 1010.)

In the second survey, emphasis was placed on medium to large sized establishments, SIC groups that had not been sampled or inadequately sampled in the first survey and expansion of the data base for SIC groups which are significant waste generators.

Relevant information regarding special wastes was obtained for each of the 1000 establishments by using a combination of telephone and on-site interviews and a comprehensive questionnaire. The data compiled included basic company statistics, quantity and characteristics of wastes generated, costs of waste disposal, and other data, where available, on processes and waste analyses. In addition, a series of questions relating to waste reuse, recovery, recycle and reduction (RRRR) were posed to each establishment.

The survey data were compiled in a standardized coded format to maintain the confidentiality of each participating establishment. A computer program was developed to facilitate data searches and analyses with respect to characteristics, quantities, types, disposal practices and other aspects.

Standard statistical procedures and the Dun and Bradstreet (1983) data base for Ontario manufacturing establishments were employed to extrapolate waste quantities to the entire Ontario manufacturing sector.

PREMISES AND POSTULATES

Certain data provided by OWMC or from other sources were accepted as given factors for the survey including:

1) Waste classification system (UCD), and regional breakdown of municipalities as developed by Proctor and Redfern (1982) for OWMC.

2) The total listing of Ontario manufacturing facilities was derived from the 1983 Dun and Bradstreet data base.

3) Only wastes generated by manufacturing establishments were inventoried. Commercial or service establishments were not included in the survey.

4) Certain waste characterization ranges were provided by OWMC (eg. organic content and fuel value).

A number of postulates or assumptions were necessary during the survey. These major assumptions are itemized as:

1) Previous waste inventories (eg. Proctor and Redfern 1982, Gore and Storrie, 1982 and others) were considered to be reasonably representative of waste generation by SIC sector and were utilized to establish initial sample stratification (ie. number of companies assigned to a specific 2 digit or 3 digit group).

2) Information provided by individual industrial establishments during telephone and on-site interviews was accurate.

3) In order to provide a consistent basis for categorization, it was necessary to develop semi-quantitative definitions of liquid, sludge and solid waste types.

4) Small companies (defined for the purposes of this study as having 10 or less production employees) as a group generate relatively small quantities of special waste and as a result such establishments should constitute only 10% of the initial sample group of 500 and not be intentionally sampled in the second 500 survey.

STATUS OF DATA

A large volume of data was collected for the 1000 interviewed establishments relating to basic company statistics, waste characteristics, waste types, waste quantities (present and future), present costs of disposal and responses to a series of RRRR related questions.

In general, the data collected in most categories was considered to be accurate, however some limitations of the data base are identified below:

1) In some areas, judgements by the interviewer were required (eg. to fit a waste into one of the several possible UCD categories or to distinguish between process wastewater and special wastes. See Appendix B for further detail).

2) Waste characteristic data were usually qualitative in nature with major constituents being identified by the interviewer or interviewee.

A subjective evaluation of the accuracy of the data provided by each establishment was made by the interviewer.

The Dun and Bradstreet data base was also found to have some constraints; eg. a number of SIC misclassifications, listing of a number of facilities which were out of business, closed or non-manufacturing, no listing for new (post 1983) establishments and absence of production employee data for a number of establishments. These limitations were not accounted for in this project; however, other OWMC projects do address these factors.

MAIN FINDINGS

A computer program specifically written for this survey enables searches and analyses to be carried out on the composite data compiled from the 1000 establishments. The program also has data editing and viewing options and is

readily expandable to accommodate additional data that may result from subsequent sample groups. Searches and analyses of the data base can be performed for any specific parameter or combination (up to 40) of parameters of interest.

Extrapolation of the sample data to the Ontario manufacturing sector as a whole resulted in projections of the total special waste generation for the Province. Separate projections were made using the 1st 500 establishment survey data and the combined 1000 establishments data. Ninety (90) percent confidence intervals were calculated for each extrapolation. Using the 1st 500 data, the total waste generation was estimated to be 1 690 000 tonnes per year with 90 percent confidence intervals of plus or minus 680 000 tonnes per year. The 1000 establishment data extrapolation resulted in a total waste generation estimate of 1 350 000 tonnes per year with 90 percent confidence intervals of plus or minus 300 000 tonnes per year.

Increasing the sample size from 500 to 1000 establishments resulted in almost a 50 percent reduction in the confidence interval range. Because of the larger sample size and the narrower confidence intervals the extrapolation for the 1000 establishment data is considered to be most representative of the Ontario situation as a whole.

It was estimated that less than 3.9 percent of the extrapolated total waste generation is due to establishments with 10 or less production employees.

The main 2-digit SIC categories contributing to the extrapolated waste production were SIC 33-Primary Metal (30.0% of estimated total), SIC 28-Chemical (15.7%), SIC 29-Petroleum (9.7%), SIC 37-Transportation (9.4%), SIC 32-Glass, etc. (8.7%), SIC 20-Food and Kindred Products (6.4%), SIC 26-Paper Products (5.3%) and SIC 34-Fabricated Metal (3.7%).

CONCLUSIONS AND RECOMMENDATIONS

The survey results are presented as a comprehensive data base on special wastes, which can be utilized by OWMC in their facilities planning and waste management processes. The data base can also be readily expanded to incorporate future data collection activities. Based on extrapolations carried out on the 1000 establishment data base, it can be concluded that:

1) The total quantity of special waste generated by manufacturing establishments in Ontario is 1 350 000 tonnes per year. (estimated)

2) The major contributors to the special waste generation are the primary metal, chemical, petroleum and transportation equipment manufacturing sectors.

The following recommendations for upgrading or further utilizing the data base are made:

1. In order to account for special wastes generated by operations not encompassed by the 49 SIC categories of this survey (eg. research and specialty laboratories, rail and truck tank car cleaning operations, boiler cleaning operations and others), a survey of a representative sample of these types of facilities should be conducted.

2. The 1000 establishment data base can be used by OWMC, in conjunction with other OWMC studies, as input to:
   -- developing waste characterization and process selection criteria for the design of treatment and disposal facilities, and
   -- future efforts to model the quantities and fate of special wastes in Ontario.

CHAPTER 1

INTRODUCTION

This chapter summarizes the background to the study and presents the project objectives.

1.1 BACKGROUND

The Ontario Waste Management Corporation (OWMC) was set up as a provincial crown agency in 1981 with a mandate for the implementation of a province-wide program for the management of special wastes. This program includes building and managing facilities for the treatment and disposal of wastes and developing programs to assist in the reduction and recycling of these wastes (OWMC, 1982 and 1983). For the purpose of this report and other OWMC work, OWMC has defined a special waste as "waste that requires special treatment", that is, waste that cannot be adequately dealt with by the conventional methods used by existing public facilities, such as municipal sewage treatment plants, municipal incinerators and municipal landfills.

A critical component of the OWMC program involves the assessment of the types and quantities of waste in Ontario that require special treatment and disposal. The assessment data will influence sizing, number and location of facilities, types of treatment and disposal processes utilized, and pricing

and marketing strategies. In 1982, OWMC carried out a "Waste Quantities Study" (Proctor and Redfern, 1982), which was designed to provide information on the kinds and quantities of wastes generated in Ontario, and their sources by industrial sector. The study methodology involved the application of production employee waste generation factors to estimate the quantity of wastes in a number of different waste categories. These data were further analyzed to provide geographic and manufacturing sector distribution patterns. Although the study provided OWMC with general information regarding waste quantities, more specific information (waste quantities, types, disposal costs, etc.) from a representative group of Ontario manufacturing establishments was needed for planning and marketing purposes.

1.2 OBJECTIVES

In order to initiate the collection of essential market data, OWMC retained Canviro Consultants Ltd. in October 1983, to carry out a marketing and quantities survey of special wastes for 500 Ontario manufacturing establishments. The objectives of this survey were to:

1) Establish a waste quantities data base to assist OWMC in the planning of treatment and disposal facilities and waste management programs.

2) Develop, by utilizing a standard statistical sampling and extrapolation procedure, estimates of the total quantities of special wastes currently generated in Ontario.

Results of the 1st 500 survey were presented to OWMC in March of 1984 (Canviro Consultants Ltd., 1984) and the results indicated that additional information was required in two specific areas; ie. waste generation data for medium to large establishments in the major waste generation SIC groups and waste generation data for specific SIC groups which were not adequately covered by the 500 establishment survey. In response to these needs, OWMC

authorized Canviro to survey an additional 500 Ontario manufacturing establishments. The following chapters of this report describe the methodology utilized to collect and analyze the survey data (Chapter 2), present and discuss results from the 1000 establishment survey (Chapter 3), extrapolate sample data to the Ontario situation as a whole (Chapter 4), and finally, present conclusions and recommendations for further analyses and/or upgrading of the data base (Chapter 5).

CHAPTER 2

SURVEY PROCEDURES

This chapter describes the approach used to carry out the survey program. The procedures used for random selection of the 1st 500 and 2nd 500 establishments are presented. Interview procedures are outlined and the statistical techniques used for data extrapolation are described.

2.1 GENERAL APPROACH

A flow chart of the overall approach used during this survey is presented in Figure 1. The study was carried out in three steps:

1) Selection of Representative Sample
2) Collection of Data
3) Extrapolation of Data

As indicated in Figure 1, the approach allowed for increases in sample size to refine the data base. The data reported herein are for an initial sample of 500 establishments surveyed from October, 1983 to March, 1984 (1st 500 survey) and a second sample of 500 establishments surveyed from April to September, 1984 (2nd 500 survey).

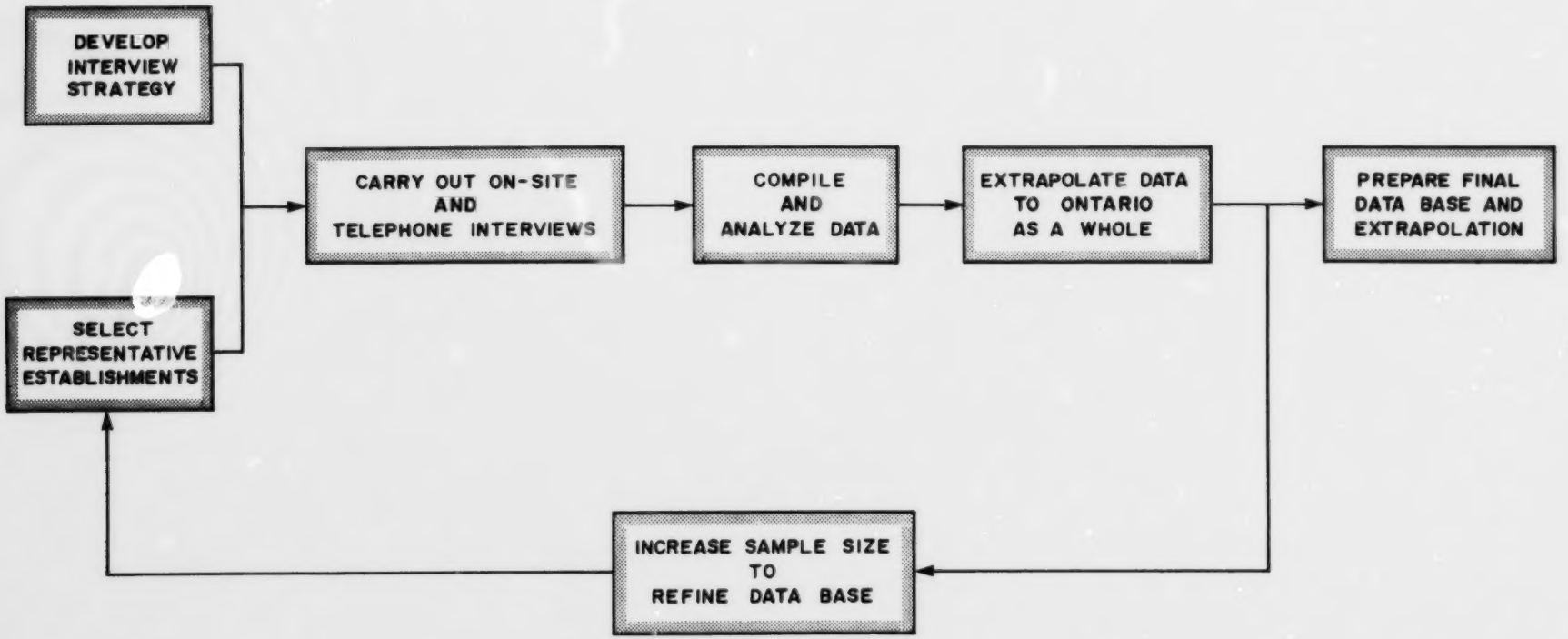
DEVELOP INTERVIEW STRATEGY
SELECT REPRESENTATIVE ESTABLISHMENTS
CARRY OUT ON-SITE AND TELEPHONE INTERVIEWS
COMPILE AND ANALYZE DATA
EXTRAPOLATE DATA TO ONTARIO AS A WHOLE
PREPARE FINAL DATA BASE AND EXTRAPOLATION
INCREASE SAMPLE SIZE TO REFINE DATA BASE

FIGURE 1—FLOW CHART OF APPROACH USED FOR MARKET ASSESSMENT PROGRAM

2.2 REVIEW OF AVAILABLE INFORMATION

At the outset of the project, data sources, particularly relevant to this survey, were reviewed to identify information which would be useful in the development of survey procedures. These sources included the OWMC Waste Quantities Study (Proctor and Redfern, 1982), the Region of Waterloo Liquid and Special Waste Inventory (Canviro Consultants, 1982), the Canadian National Inventory of Hazardous and Toxic Wastes (Gore and Storrie, 1982).

2.3 DEVELOPMENT OF INTERVIEW STRATEGY

After consultations with OWMC marketing, hearings, process and engineering personnel and the OWMC-MOE Waste Quantities Working Group, an interview strategy was developed which incorporated the following key elements:

1) Initial contact with candidate establishments was to be made in writing by OWMC.

2) A mixture of telephone (≃ 75%) and on-site interviews (≃ 25%) were to be conducted for the selected establishments.

3) Data collected from the establishments were to be treated as confidential and establishments were to be identified by a code number.

4) A standardized format for collecting and compiling survey data was to be utilized which would be compatible with computerized analysis.

2.4 SELECTION OF REPRESENTATIVE SAMPLE OF ESTABLISHMENTS

A sample of 500 establishments (2.5% of the total number of establishments in the Ontario manufacturing sector according to Dun and Bradstreet, 1983) was selected for the initial survey. As indicated previously, another 500 establishments were subsequently selected and surveyed to bring the total sample size to 1000.

2.4.1 SELECTION OF FIRST 500 SAMPLE

The first step in the selection of the representative group of establishments involved a determination of how the sample group should be distributed over the U.S. Standard Industrial Classifications (SIC) [U.S. Government Statistical Policy Division (1972), see Appendix A for complete listing of SICs] that potentially generate special wastes. The relevant SIC categories are listed in Table 1. The following criteria were considered in selecting the number of sample establishments per SIC group:

1) The relative contribution of that SIC group to the total waste generation based on available waste quantity information (primarily Proctor and Redfern, 1982).

2) In order to sample a cross-section of the major waste generator SIC groups (eg. 28, 33, 34 and 35), various types of manufacturing within these groups were further delineated to three digit SICs.

3) Any two digit SIC sample group should contain a minimum of 5 establishments to provide a sufficient statistical basis for data extrapolation.

Dun and Bradstreet (D & B) (1983) indicated that 57 percent of the Ontario manufacturing sector is comprised of establishments with 10 or less employees. Recognizing that a large portion of these small establishments probably generate very little or no special waste, and in an effort to direct

TABLE 1

PROPOSED BREAKDOWN OF SAMPLE FOR 1st 500 SURVEY

SIC	DESCRIPTION*	ESTABLISHMENT SIZE ≤10	ESTABLISHMENT SIZE >10	TOTAL NUMBER OF ESTABLISHMENTS
16	Construction	1 (43)**	4 (37)	5 (80)
20	Food & Kindred Prod.	1 (567)	9 (641)	10 (1208)
22	Textile Mill Prod.	1 (212)	9 (189)	10 (401)
23	Apparel	1 (575)	9 (452)	10 (1027)
24	Lumber & Wood	1 (982)	9 (424)	10 (1406)
25	Furniture & Fixtures	1 (638)	9 (392)	10 (1030)
26	Paper Products	2 (102)	13 (271)	15 (373)
27	Printing & Publishing	2 (1795)	13 (749)	15 (2544)
281	Inorganic Chemicals	1 (56)	13 (49)	14 (105)
282	Plastic & Synthetics	1 (35)	9 (63)	10 (98)
283	Biological Products	0 (36)	3 (80)	3 (116)
284	Soaps, Detergents, etc.	2 (120)	22 (89)	24 (209)
285	Paints & Varnishes	1 (35)	3 (51)	4 (86)
286	Ind. Organic Chem.	1 (19)	8 (23)	9 (42)
287	Fertilizers	1 (49)	3 (19)	4 (68)
289	Adhesives & Sealants, etc.	2 (87)	20 (89)	22 (176)
29	Petroleum	1 (38)	9 (43)	10 (81)
30	Rubber & Plastics	1 (345)	9 (386)	10 (731)
31	Leather Products	1 (115)	9 (110)	10 (225)
32	Stone, Clay, Glass & Concrete	1 (535)	9 (326)	10 (861)
331	Steel	2 (57)	15 (89)	17 (146)
332	Foundries	1 (22)	9 (60)	10 (82)
333	Prim Smelting (non-ferrous)	1 (6)	3 (4)	4 (10)
334	Sec. Smelting (non-ferrous)	0 (12)	3 (20)	3 (32)
335	Rolling & Draw. (non-ferrous)	1 (22)	5 (39)	6 (61)
336	Non-ferrous Casting	1 (48)	4 (74)	5 (122)
339	Heat Treating	0 (17)	3 (20)	3 (37)
341	Cans & Containers	0 (12)	2 (15)	2 (27)
342	Tools & Hardware	1 (97)	8 (83)	9 (180)
343	Plumbing & Heat Equip.	1 (61)	5 (62)	6 (123)
344	Metal Work. Equip.	4 (551)	35 (380)	39 (931)
345	Screws & Bolts, etc.	1 (34)	3 (40)	4 (74)
346	Forging & Stampings	1 (123)	10 (129)	11 (252)
347	Electroplating	1 (118)	10 (109)	11 (227)
348	Arms & Ammo.	0 (5)	2 (2)	2 (7)
349	Springs & Valves	2 (162)	14 (193)	16 (355)
351	Turbines & Engines	0 (13)	2 (13)	2 (26)
352	Farm Equip.	1 (94)	2 (38)	3 (132)
353	Construction Equip., etc.	1 (136)	11 (160)	12 (296)
354	Tools & Dies	1 (482)	11 (295)	12 (777)
355	Manufacturing Equip., etc.	1 (138)	8 (102)	9 (240)
356	Bearings, etc.	1 (184)	11 (163)	12 (347)
357	Electronic Equip	1 (64)	6 (70)	7 (134)
358	Automatic Machines	1 (71)	5 (79)	6 (150)
359	Carburetors, etc.	1 (563)	8 (185)	9 (748)
36	Elec. & Electronic Mach.	2 (567)	18 (535)	20 (1102)
37	Transportation Equip.	3 (319)	22 (265)	25 (584)
38	Measuring etc. Instrum.	1 (277)	9 (195)	10 (472)
39	Misc. Manufacturing	1 (804)	9 (349)	10 (1153)
	TOTALS	55 (11 443)	445 (8250)	500 (19 693)

* Refer to SIC Master list (Appendix A) for complete description of SIC categories.

** Values in parentheses indicate total number of establishments in the strata according to Dun & Bradstreet (1983).

a greater portion of the project resources to larger sized establishments, it was decided that the less than 10 employee operations were to comprise no more than 10% of the initial 500 sample group.

By application of the selection criteria and by splitting the sample with respect to (1) ≤10 employees and (2) >10 employees, the proposed distribution for the 1st 500 survey was broken down into the 98 strata (49 SICs x 2 sizes shown in Table 1).

The D & B (1983) data base for Ontario manufacturing establishments provided establishment information for this survey. This particular base was used since it was judged to be the most complete of the available data bases and it was available in a computer readable format. The total number of establishments, per D & B, shown in each stratum in Table 1 include all those establishments for which employee numbers are listed. Some 530 establishments (2.7% of total) are listed by D & B which have no employee data, and therefore, could not be assigned to either of the two size ranges.

2.4.2 SELECTION OF SECOND 500 SAMPLE

The results of the 1st 500 survey were reviewed by OWMC and other consultants who were using the data base for Market Assessment Program activities. It was subsequently decided that the data base should be expanded by surveying a 2nd 500 establishment sample. Selection criteria for the 2nd 500 sample were set up so that the survey would include:

1) Approximately 300 establishments were distributed over those SIC categories identified by the 1st 500 survey extrapolated data to represent the largest sources of waste generation. A total of 30 establishments (including those in the first survey) were to be included in each category up to a maximum of 50 percent of the total establishments in the category.

2) The total number of establishments in each of the above SIC categories was sub-divided into 5 size ranges according to the number of

production employees (D & B, 1983). One fifth of the new establishments for that SIC category were to be selected at random from each size range.

3) Emphasis was placed on larger establishments, accordingly, establishments with 10 or less production employees were not to be intentionally sampled.

4) The remainder of establishments ($\approx$ 200) in the sample were distributed over strata which were considered to not have been adequately represented in the first 500 survey or SIC categories which were judged to be potential sources of special wastes (eg. SIC 2491-Wood Preserving) and were not represented at all in the first 500 survey.

The breakdown of the proposed number of establishments to be sampled per major SIC strata is shown in Table 2a. The breakdown for the remainder of the second 500 sample is shown in Table 2b.

2.4.3 RANDOM SELECTION TECHNIQUE

The establishments in each population stratum (SIC x size) of the D & B data base were sequentially numbered and a set of sample identification numbers were randomly generated for each stratum. A second replacement set of identification numbers was also generated for each stratum.

The initial group of 500 establishments was selected from the D & B data file using the randomly generated identification numbers. If for any reason an establishment had to be replaced during the survey, the replacement was selected utilizing the replacement sample identification numbers. The second 500 group of establishments were randomly selected utilizing identical procedures to the first 500 except that individual random numbers and replacement numbers were generated for each of five production employee size ranges for each stratum.

TABLE 2

PROPOSED BREAKDOWN OF ESTABLISHMENTS FOR 2nd 500 SURVEY

(a) FOR MAJOR WASTE GENERATING SICs

SIC STRATA	DESCRIPTION*	TOTAL NUMBER OF ESTABLISHMENTS IN POPULATION (Dun & Bradstreet, 1983)	NUMBER OF ESTABLISHMENTS IN FIRST 500 SURVEY	ADDITIONAL NUMBER TO BE INCLUDED IN SECOND 500 SURVEY	TOTAL OF BOTH SURVEYS	TOTAL SURVEY AS % OF POPULATION
371	Motor vehicles & car bodies	183	19	11	30	16.4
372-9	Remainder of transportation equip.	82	5	25	30	36.6
32	Stone, glass, clay & concrete	326	8	22	30	9.2
281	Inorganic chemicals	49	4	21	25	51.0
334	Sec. smelting (non-ferrous)	20	3	7	10	50.0
26	Paper products	271	11	19	30	11.1
282	Plastics & synthetics	63	8	22	30	47.6
286	Ind. organic chemicals	23	5	7	12	52.2
336	Non-ferrous casting	74	3	27	30	40.5
30	Rubber & plastics	386	21	9	30	7.8
311	Leather tanning & finishing	16	2	6	8	50.0
29	Petroleum	43	6	16	22	51.2
349	Springs & valves	193	15	15	30	15.5
332	Foundries	60	10	20	30	50.0
333	Prim. smelting (non-ferrous)	4	1	1	2	50.0
285	Paints & varnishes	51	3	28	31	60.8
347	Electroplating	109	7	23	30	27.5
25	Furniture & fixtures	392	7	23	30	7.7
331	Steel	89	3	27	30	33.7

(b) FOR REMAINING SIC STRATA

SIC STRATA	DESCRIPTION *	ADDITIONAL NUMBER TO BE INCLUDED IN SECOND 500 SURVEY	NUMBER OF ESTABLISHMENTS IN STRATA IN FIRST 500 SAMPLES	TOTAL OF BOTH SURVEYS
201	Meat packing	3 (80)**		
203	Canned & frozen goods	4 (87)		
204	Flour, cereal, etc.	3 (76)	8	
207	Oils, etc.	3 (13)		33
2082-85	Beer, wine & spirits	6 (29)	TOTAL FOR	
2086	Soft drinks	3 (52)	SIC 20	
209	Other food	3 (46)		
221	Cotton mills	3 (14)		
222	Silk & fabric mill	3 (15)	8	
223	Wool mills	3 (10)		26
227	Carpets & rugs	3 (10)	TOTAL FOR	
228	Yarn mills	3 (24)	SIC 22	
229	Other fabric prod.	3 (37)		
2385	Raincoats, etc.	2 (2)	10	
2394	Canvas prod.	3 (30)	TOTAL FOR	18
2399	Other textile prod.	3 (29)	SIC 23	
2491	Wood perserving	3 (5)	10 TOTAL FOR SIC 24	13
275	Commercial print, etc.	3 (377)	11	18
279	Photo engraving, etc.	4 (52)	TOTAL FOR SIC 27	
283	Pharmaceuticals, etc.	5 (80)	2	7
287	Fertilizer & pesticides	6 (19)	1	7
335	Non-ferrous forming	5 (39)	9	14
339	Other primary metal	5 (20)	1	6
341	Cans, drums, etc.	5 (15)	0	5
342	Cutlery, etc.	5 (83)	4	9
343	Heating equip.	3 (62)	3	6
345	Screws & bolts	4 (40)	4	8
346	Forgings	3 (129)	7	10
351	Turbines & engines	5 (13)	0	5
352	Farm machinery	8 (38)	3	11
353	Construction equip.	6 (160)	9	15
354	Tools & dies, etc.	8 (295)	9	17
359	Other machinery	5 (185)	4	9
361	Transformers, etc.	3 (57)		
362	Motors & generators	5 (64)		
363	Household equip.	3 (43)	17	
364	Lamps, etc.	3 (91)		44
366	Telephone & radio	3 (97)	TOTAL FOR	
367	TV tubes, etc.	5 (102)	SIC 36	
369	Batteries, etc.	5 (49)		
382	Controls, etc.	5 (82)	5	
384	Surgical instruments	5 (45)	TOTAL FOR	20
386	Photo equip.	5 (21)	SIC 38	
3914	Silverware	3 (7)	8	
395	Pens, pencils, etc.	3 (32)	TOTAL FOR	19
399	Other	5 (156)	SIC 39	

* Refer to SIC Master List in Appendix A for complete description of SIC categories.

** Values in parentheses indicate number of establishments in the population according to DUN & BRADSTREET (1983).

For each establishment selected, an output was generated which included the following D & B information:

- -- principal officer of company
- -- telephone number
- -- business name
- -- street address
- -- city
- -- postal code
- -- mailing address
- -- line of business
- -- employees at location
- -- SIC number

Each establishment on the sample list was contacted by telephone to determine if the listed address, principal officer, and other data were correct and whether the indicated establishment was, in fact, a manufacturing facility. Establishments which were found to be out of business, unable to be contacted, non-manufacturing or uncooperative were replaced with another establishment from the replacement list.

2.5 DATA COLLECTION AND ANALYSES

Mailing lists of the 1000 establishments were provided to OWMC in blocks of approximately 50 establishments. OWMC then mailed an information package (Appendix C) to each establishment which provided an overview of the OWMC mandate and specific details on the survey. The cover letter indicated that the specific establishment would be contacted in the near future by Canviro.

Each of the 1000 establishments was assigned to one of ten interviewers. The interviewer then contacted the establishment via telephone. Based on this initial telephone contact, a decision was made whether the relevant data could be obtained by telephone interview or whether an on-site interview was warranted. In general, medium to large sized establishments with relatively large quantities of waste and/or a variety of wastes were designated for on-site interviews.

2.5.1 SURVEY QUESTIONNAIRE

A standard questionnaire and coding form was developed for this survey (see Appendix B for the complete questionnaire and coding form). A summary of the items addressed by the questionnaire are listed in Table 3.

TABLE 3

SUMMARY OF INFORMATION CATEGORIES INCLUDED IN SURVEY QUESTIONNAIRE[1]

A. Basic Statistics on Company
- SIC
- sales
- production quantity

B. Details of Wastewater Pretreatment
- process wastewaters
- type of treatment

C. Quantity and Characteristics of Special Wastes
- description
- UCD classifications
- pumpability
- pH
- % solids
- organic/inorganic content
- fuel value
- flash point
- % water
- main constituents
- availability of additional data
- special constituents
- fire/explosive hazard
- storage method
- storage time
- disposal method
- MOE Waybill information
- present quantity of waste
- disposal costs

D. Questions Pertaining to Recovery, Reuse, Reduction and Recycle
- quantity of waste in future
- consideration of Reuse, Recovery, Recycle or Reduction (RRRR)
- potential for further reduction
- potential for recover, recycle or reuse (RRR)

E. Amenability to Future Sampling

1. See Appendix B for complete questionnaire.

During the collection and compilation of data for specific establishments, interviewers were often required to make a decision between one or more alternatives; for example:

1) When a special waste could potentially fit into one or more possible UCD classifications, what is the most appropriate UCD?

2) What is the appropriate physical description (liquid, sludge, solid, other) for the waste?

3) Can the waste be considered as a process wastewater (not to be coded), or is it a special waste?

4) What is the potential for reduction, recovery, reuse or recycle?

In order to make these decisions as consistent as possible from interviewer and from establishment to establishment, a set of interviewer guidelines was prepared. These guidelines are presented in Appendix B.

Wherever possible, additional data such as process flow diagrams, waste analyses, etc. were obtained from the establishment and included in the master file of original completed questionnaires.

The questionnaire data, for each establishment, were summarized on the standard coding form (see Figure 1 in Appendix B). These data were used for all subsequent analyses.

2.5.2 DATA ANALYSIS PROGRAM

A computer program was developed for carrying out searches on the data file for individual categories (eg. UCD, SIC, etc.) or combination of categories. A complete description of the program, together with example outputs, is provided in Appendix D.

2.6 EXTRAPOLATION PROCEDURES

The extrapolation procedures used for this survey are those applicable to stratified random sampling. For full details refer to Cochran (1959). In this survey the population of Ontario establishments was divided into 98 strata defined by SIC and establishment size boundaries (as shown in Table 1). These strata were non-overlapping and the number of establishments in any given strata is given by N_h, and a sample n_h was selected from each strata, where

$h = 1, 2, \ldots, L$ (L=total number of strata = 98 in this case)

The total waste generated expressed as metric tonnes per year by each establishment in the sample group was calculated by adding the waste quantities for individual waste streams after making appropriate weight conversions of Igal, cubic yards or tons to metric tonnes. This quantity is designated as y_{hi}. The mean waste generation for any stratum is given by:

$$\bar{y}_h = \frac{\sum_{i=1}^{n_h} y_{hi}}{n_h} \qquad (1)$$

The variance for the waste generation by any stratum is given by:

$$s_h^2 = \frac{1}{(n_h-1)} \sum_{i=1}^{n_h} (y_{hi} - \bar{y}_h)^2 \qquad (2)$$

The estimate of the overall mean waste generation for the stratified sample is given by:

$$\bar{y}_{st} = \frac{\sum_{h=1}^{L} N_h \bar{y}_h}{N} \qquad (3)$$

where: N_h = population number of establishments in the h^{th} strata
$\bar{y}_h$ = mean for strata h (Equation 1)
N = total number of industries in the population

The variance of the overall mean is given by:

$$s^2(\bar{y}_{st}) = \frac{1}{N^2} \sum_{h=1}^{L} N_h(N_h - n_h) \frac{s_h^2}{n_h} \qquad (4)$$

The formulae for confidence limits for the mean waste generation and total waste generation by the population are as follows:

Mean Waste Generation per establishment: $\bar{y}_{st} \pm t\ s\ (\bar{y}_{st})$

Total Waste Generation for manufacturing sector: $N\bar{y}_{st} \pm t\ N_s\ (\bar{y}_{st})$

Where t is read from tables of Student's t for the appropriate confidence level and degrees of freedom. Degrees of freedom are calculated from Satterthwaite's formula (Cochran, 1959).

CHAPTER 3

ANALYSES OF SURVEY DATA

This chapter presents the data compiled from the two surveys, and an interpretation of selected data is given. Most of these analyses were carried out utilizing the search program described in Appendix D. Since OWMC and its consultants will be carrying out further analyses on the data base for specific purposes, it is not intended in this report to provide an indepth analysis of the data base. Only aspects relevant to the basic make-up of the data base and the objectives of this report will be presented and discussed. Extrapolation of the sample data to the Ontario situation as a whole is described in Chapter 4.

3.1 THE SAMPLE

The final number of establishments surveyed was 1010 (495 out of 500 in the first group and 515 out of 521 in the second group). The total of 1010 incorporates all the replacements that were required throughout the survey. The number of replacements and the reasons for replacement are summarized in Table 4.

TABLE 4

NUMBER OF REPLACEMENTS REQUIRED FOR 1000 ESTABLISHMENT SURVEY

REASON FOR REPLACEMENT	NO. REQUIRED FOR FIRST 500	NO. REQUIRED FOR SECOND 500	TOTAL	
			NO.	% OF 1305
Non-manufacturing Company	68	47	115	8.8
Out of Business or Unable to Contact	31	27	58	4.4
Obvious Misclassification	25	—	25	1.9
Not Cooperative	53	54	107	8.2
TOTAL	177	128	305	23.3

A total of 305 replacements were used for both surveys with the largest single reason for replacement being a determination during the initial telephone screening or by the interviewer that the establishment was not involved in manufacturing. About 4.4 percent of the establishments contacted were out of business or unable to be contacted via telephone. If it was apparent from the initial telephone screening that the establishment from the D & B data base was an obvious SIC misclassification, the establishment was replaced. Approximately 8.2 percent of the establishments contacted refused to participate in the survey.

The statistical basis for selecting the 1000 group (ie. proposed distribution over SIC and establishment sizing) was presented previously in Tables 1 and 2. The actual samples that resulted after collection of the inventory data is shown in Tables 5, 6 and 7 for the 1st 500, 2nd 500 and combined 1000, respectively. Note that there were some changes (proposed versus actual) in the number of establishments in particular strata due to a change in the primary SIC and/or changes in the number of production employees. There was also an increase (actual versus proposed) in the number of establishments in the ≤10 group (ie. increased from 55 to 119 for the first survey and from 0 to 66 for the second survey).

TABLE 5

ACTUAL BREAKDOWN OF 1st 500 SAMPLE SURVEY

SIC	DESCRIPTION*	ESTABLISHMENT SIZE				TOTAL NUMBER OF ESTABLISHMENTS	
		≤10		>10			
16	Construction	1	(43)**	4	(37)	5	(80)
20	Food & Kindred Prod.	2	(567)	8	(641)	10	(1208)
22	Textile Mill Prod.	1	(212)	8	(189)	9	(401)
23	Apparel	1	(575)	10	(452)	11	(1027)
24	Lumber & Wood	2	(982)	10	(424)	12	(1406)
25	Furniture & Fixtures	3	(638)	7	(392)	10	(1030)
26	Paper Products	2	(102)	11	(271)	13	(373)
27	Printing & Publishing	5	(1795)	11	(749)	16	(2544)
281	Inorganic Chemicals	5	(56)	4	(49)	9	(105)
282	Plastic & Synthetics	1	(35)	8	(63)	9	(98)
283	Biological Products	1	(36)	2	(80)	3	(116)
284	Soaps, Detergents, etc.	6	(120)	18	(89)	24	(209)
285	Paints & Varnishes	4	(35)	3	(51)	7	(86)
286	Ind. Organic Chem.	0	(19)	5	(23)	5	(42)
287	Fertilizers	3	(49)	1	(19)	4	(68)
289	Adhesives & Sealants, etc.	10	(87)	11	(89)	21	(176)
29	Petroleum	3	(38)	6	(43)	9	(81)
30	Rubber & Plastics	4	(345)	21	(386)	25	(731)
31	Leather Products	0	(115)	10	(110)	10	(225)
32	Stone, Clay, Glass & Concrete	1	(535)	8	(326)	9	(861)
331	Steel	2	(57)	3	(89)	6	(146)
332	Foundries	1	(22)	10	(60)	11	(82)
333	Prim Smelting (non-ferrous)	0	(6)	1	(4)	1	(10)
334	Sec. Smelting (non-ferrous)	0	(12)	3	(20)	3	(32)
335	Rolling & Draw. (non-ferrous)	1	(22)	9	(39)	10	(61)
336	Non-ferrous Casting	1	(48)	3	(74)	4	(122)
339	Heat Treating	1	(17)	1	(20)	2	(37)
341	Cans & Containers	0	(12)	0	(15)	0	(27)
342	Tools & Hardware	0	(97)	4	(83)	4	(180)
343	Plumbing & Heat Equip.	3	(61)	3	(62)	6	(123)
344	Metal Work. Equip.	8	(551)	31	(380)	39	(931)
345	Screws & Bolts, etc.	1	(34)	4	(40)	5	(74)
346	Forging & Stampings	2	(123)	8	(129)	10	(252)
347	Electroplating	4	(118)	7	(109)	11	(227)
348	Arms & Ammo.	1	(5)	0	(2)	1	(7)
349	Springs & Valves	6	(162)	15	(193)	21	(355)
351	Turbines & Engines	0	(13)	0	(13)	0	(26)
352	Farm Equip.	0	(94)	3	(38)	3	(132)
353	Construction Equip., etc.	3	(136)	9	(160)	12	(296)
354	Tools & Dies	1	(482)	9	(295)	10	(777)
355	Manufacturing Equip., etc.	2	(138)	10	(102)	12	(240)
356	Bearings, etc.	1	(184)	10	(163)	11	(347)
357	Electronic Equip	2	(64)	4	(70)	6	(134)
358	Automatic Machines	3	(71)	4	(79)	7	(150)
359	Carburetors, etc.	3	(563)	4	(185)	7	(748)
36	Elec. & Electronic Mach.	5	(567)	18	(535)	23	(1102)
37	Transportation Equip.	3	(319)	24	(265)	27	(584)
38	Measuring etc. Instrum.	8	(277)	5	(195)	13	(472)
39	Misc. Manufacturing	2	(804)	8	(349)	10	(1153)
	TOTALS	119	(11 443)	376	(8250)	495	(19 693)

* Refer to SIC Master list (Appendix A) for complete description of SIC categories.

** Values in parenthesis indicate industry population number according to Dun & Bradstreet (1983).

TABLE 6

ACTUAL BREAKDOWN OF 2nd 500 SAMPLE SURVEY

SIC	DESCRIPTION*	ESTABLISHMENT SIZE				TOTAL NUMBER OF ESTABLISHMENTS	
		≤10		>10			
16	Construction	0	(43)**	0	(37)	0	(80)
20	Food & Kindred Prod.	3	(567)	23	(641)	26	(1208)
22	Textile Mill Prod.	0	(212)	16	(189)	16	(401)
23	Apparel	0	(575)	5	(452)	5	(1027)
24	Lumber & Wood	0	(982)	3	(424)	3	(1406)
25	Furniture & Fixtures	3	(638)	20	(392)	23	(1030)
26	Paper Products	0	(102)	20	(271)	20	(373)
27	Printing & Publishing	2	(1795)	6	(749)	8	(2544)
281	Inorganic Chemicals	2	(56)	12	(49)	14	(105)
282	Plastic & Synthetics	2	(35)	16	(63)	18	(98)
283	Biological Products	0	(36)	4	(80)	4	(116)
284	Soaps, Detergents, etc.	0	(120)	3	(89)	3	(209)
285	Paints & Varnishes	8	(35)	17	(51)	25	(86)
286	Ind. Organic Chem.	2	(19)	6	(23)	8	(42)
287	Fertilizers	1	(49)	6	(19)	7	(68)
289	Adhesives & Sealants, etc.	0	(87)	2	(89)	2	(176)
29	Petroleum	2	(38)	9	(43)	11	(81)
30	Rubber & Plastics	2	(345)	23	(386)	25	(731)
31	Leather Products	1	(115)	6	(110)	7	(225)
32	Stone, Clay, Glass & Concrete	5	(535)	17	(326)	22	(861)
331	Steel	0	(57)	13	(89)	13	(146)
332	Foundries	0	(22)	18	(60)	18	(82)
333	Prim Smelting (non-ferrous)	0	(6)	0	(4)	0	(10)
334	Sec. Smelting (non-ferrous)	1	(12)	5	(20)	6	(32)
335	Rolling & Draw. (non-ferrous)	0	(22)	7	(39)	7	(61)
336	Non-ferrous Casting	2	(48)	17	(74)	19	(122)
339	Heat Treating	2	(17)	4	(20)	6	(37)
341	Cans & Containers	0	(12)	3	(15)	3	(27)
342	Tools & Hardware	1	(97)	2	(83)	3	(180)
343	Plumbing & Heat Equip.	0	(61)	2	(62)	2	(123)
344	Metal Work. Equip.	3	(551)	8	(380)	11	(931)
345	Screws & Bolts, etc.	1	(34)	3	(40)	4	(74)
346	Forging & Stampings	0	(123)	6	(129)	6	(252)
347	Electroplating	2	(118)	21	(109)	23	(227)
348	Arms & Ammo.	0	(5)	0	(2)	0	(7)
349	Springs & Valves	2	(162)	22	(193)	24	(355)
351	Turbines & Engines	1	(13)	3	(13)	4	(26)
352	Farm Equip.	1	(94)	5	(38)	6	(132)
353	Construction Equip., etc.	2	(136)	7	(160)	9	(296)
354	Tools & Dies	3	(482)	4	(295)	7	(777)
355	Manufacturing Equip., etc.	1	(138)	2	(102)	3	(240)
356	Bearings, etc.	1	(184)	2	(163)	3	(347)
357	Electronic Equip	0	(64)	0	(70)	0	(134)
358	Automatic Machines	0	(71)	0	(79)	0	(150)
359	Carburetors, etc.	0	(563)	2	(185)	2	(748)
36	Elec. & Electronic Mach.	2	(567)	22	(535)	24	(1102)
37	Transportation Equip.	3	(319)	34	(265)	37	(584)
38	Measuring etc. Instrum.	3	(277)	9	(195)	12	(472)
39	Misc. Manufacturing	2	(804)	14	(349)	16	(1153)
	TOTALS	66	(11 443)	449	(8250)	515	(19 693)

* Refer to SIC Master list (Appendix A) for complete description of SIC categories.

** Values in parenthesis indicate industry population number according to Dun & Bradstreet (1983).

TABLE 7

ACTUAL BREAKDOWN OF 1000 COMBINED SAMPLE SURVEY

SIC	DESCRIPTION*	ESTABLISHMENT SIZE				TOTAL NUMBER OF ESTABLISHMENTS	
		≤10		>10			
16	Construction	1	(43)**	4	(37)	5	(80)
20	Food & Kindred Prod.	5	(567)	31	(641)	36	(1208)
22	Textile Mill Prod.	1	(212)	24	(189)	25	(401)
23	Apparel	1	(575)	15	(452)	16	(1027)
24	Lumber & Wood	2	(982)	13	(424)	15	(1406)
25	Furniture & Fixtures	6	(638)	27	(392)	33	(1030)
26	Paper Products	2	(102)	31	(271)	33	(373)
27	Printing & Publishing	7	(1795)	17	(749)	24	(2544)
281	Inorganic Chemicals	7	(56)	16	(49)	23	(105)
282	Plastic & Synthetics	3	(35)	24	(63)	27	(98)
283	Biological Products	1	(36)	6	(80)	7	(116)
284	Soaps, Detergents, etc.	6	(120)	21	(89)	27	(209)
285	Paints & Varnishes	12	(35)	20	(51)	32	(86)
286	Ind. Organic Chem.	2	(19)	11	(23)	13	(42)
287	Fertilizers	4	(49)	7	(19)	11	(68)
289	Adhesives & Sealants, etc.	10	(87)	13	(89)	23	(176)
29	Petroleum	5	(38)	15	(43)	20	(81)
30	Rubber & Plastics	6	(345)	44	(386)	50	(731)
31	Leather Products	1	(115)	16	(110)	17	(225)
32	Stone, Clay, Glass & Concrete	6	(535)	25	(326)	31	(861)
331	Steel	2	(57)	16	(89)	18	(146)
332	Foundries	1	(22)	28	(60)	29	(82)
333	Prim Smelting (non-ferrous)	0	(6)	1	(4)	1	(10)
334	Sec. Smelting (non-ferrous)	1	(12)	8	(20)	9	(32)
335	Rolling & Draw. (non-ferrous)	1	(22)	16	(39)	17	(61)
336	Non-ferrous Casting	3	(48)	20	(74)	23	(122)
339	Heat Treating	3	(17)	5	(20)	8	(37)
341	Cans & Containers	0	(12)	3	(15)	3	(27)
342	Tools & Hardware	1	(97)	6	(83)	7	(180)
343	Plumbing & Heat Equip.	3	(61)	5	(62)	8	(123)
344	Metal Work. Equip.	11	(551)	39	(380)	50	(931)
345	Screws & Bolts, etc.	2	(34)	7	(40)	9	(74)
346	Forging & Stampings	2	(123)	14	(129)	16	(252)
347	Electroplating	6	(118)	28	(109)	34	(227)
348	Arms & Ammo.	1	(5)	0	(2)	1	(7)
349	Springs & Valves	8	(162)	37	(193)	45	(355)
351	Turbines & Engines	1	(13)	3	(13)	4	(26)
352	Farm Equip.	1	(94)	8	(38)	9	(132)
353	Construction Equip., etc.	5	(136)	16	(160)	21	(296)
354	Tools & Dies	4	(482)	13	(295)	17	(777)
355	Manufacturing Equip., etc.	3	(138)	12	(102)	15	(240)
356	Bearings, etc.	2	(184)	12	(163)	14	(347)
357	Electronic Equip	2	(64)	4	(70)	6	(134)
358	Automatic Machines	3	(71)	4	(79)	7	(150)
359	Carburetors, etc.	3	(563)	6	(185)	9	(748)
36	Elec. & Electronic Mach.	7	(567)	40	(535)	47	(1102)
37	Transportation Equip.	6	(319)	58	(265)	64	(584)
38	Measuring etc. Instrum.	11	(277)	14	(195)	25	(472)
39	Misc. Manufacturing	4	(804)	22	(349)	26	(1153)
	TOTALS	185	(11 443)	825	(8250)	1010	(19 693)

* Refer to SIC Master list (Appendix A) for complete description of SIC categories.

** Values in parenthesis indicate industry population number according to Dun & Bradstreet (1983).

A comparison of the actual survey data for the 1st 500 establishments with the D & B data with respect to SIC showed that:

-- for 74 or 15% of the industries primary SICs (listed versus actual) did not agree at the two digit level.
-- for 142 or 28% of the industries primary SICs did not agree at the three digit level.
-- for 189 or 38% of the industries primary SICs did not agree at the four digit level.

These SIC classification discrepancies in the data base may have an impact on any extrapolations made with the data. Within the context of this survey, it is difficult to ascertain the magnitude and nature of this impact. However, other OWMC projects do address this aspect.

3.1.1 GEOGRAPHIC DISTRIBUTION

The distribution of the 1000 establishment sample over the 49 Ontario Regions is shown in Figure 2. For comparative purposes, the total number of establishments in each region is also shown. It is apparent that survey establishments are distributed throughout Ontario with a large number of the surveyed establishments being in Southern Ontario. Overall, the sample of 1010 establishments represented 5.1% of the total of 19 694 manufacturing establishments in Ontario.

3.1.2 COMPANY SIZE DISTRIBUTION

The breakdown of the sample establishments by number of production employees for each survey is shown in Table 8.

FIGURE 2—GEOGRAPHIC DISTRIBUTION OF 1000 SAMPLED ESTABLISHMENTS AN

HMENTS AND TOTAL NUMBER OF MANUFACTURING ESTABLISHMENTS IN ONTARIO

TABLE 8

BREAKDOWN OF ESTABLISHMENT SIZE BY NUMBER OF PRODUCTION EMPLOYEES

PRODUCTION EMPLOYEE SIZE INTERVAL	NUMBER OF ESTABLISHMENTS IN INTERVAL			
	FIRST 500	SECOND 500	TOTAL	% OF TOTAL SAMPLE
1 - 10	119	66	185	18.3
11 - 30	165	180	345	34.2
31 - 50	69	84	153	15.1
51 - 100	66	86	152	15.0
101 - 250	49	65	114	11.3
251 - 500	18	23	41	4.1
500 +	9	11	20	2.0
TOTAL	495	515	1010	100.0

As indicated in Table 8, and as intended from the sample selection procedures described in Chapter 2, more of the establishments in the second 500 group were medium to large companies (ie. more than 10 production employees).

3.1.3 BASIC SURVEY STATISTICS

Some of the basic survey statistics which do not relate directly to waste characteristics or waste quantities, but provide further information on the overall survey results are presented in Table 9.

TABLE 9

BASIC SURVEY STATISTICS SUMMARY

STATISTIC	FIRST 500	SECOND 500	TOTAL
Number of Establishment(s) Interviewed	104 On-Site 391 Telephone 495 TOTAL	127 On-Site 388 Telephone 515 TOTAL	231 779 1010
Number of Establishment(s) with UCD Wastes	312	365	677
Number of Establishment(s) without UCD Wastes	183	150	333
Number of Establishment(s) that Provided Production Data	296	286	582
Number of Establishment(s) with Some Form of Pretreatment for Process Wastes	87	114	201
Number of Establishment(s) with Wastes for which Additional Data was Obtained	94	113	207
Total Number of Individual UCD Waste Streams	743 (avg. of 2.4 UCD Waste Streams per Establishment) *	767 (avg. of 2.1 UCD Waste Streams per Establishment) *	1510 (Avg. of 2.2 UCD Waste Streams per Establishment) *

* Refers to average of UCD waste streams per establishment with UCD wastes.

3.2 WASTE TYPES AND QUANTITIES GENERATED BY SURVEY SAMPLE

The breakdown of the wastes generated by the each of the two surveys and the total 1000 establishment survey with respect to UCD categories and OWMC major groups, are shown in Tables 10 and 11, respectively.

The total waste identified by the 1st 500 and 2nd 500 surveys was 147 505 tonnes, and 165 939 tonnes respectively for a survey total of 313 444 tonnes. As might be expected, with its greater emphasis on larger establishments, the second survey identified more (13%) waste than the first survey.

TABLE 10

SURVEYED WASTE QUANTITIES BY UCD CATEGORIES

(tonnes per year)

UCD WASTE	DESCRIPTION	TYPICAL WASTES	1st 500 SURVEY	2nd 500 SURVEY	TOTAL SURVEY	% OF TOTAL
11 ACIDIC SOLUTIONS						
111	Acidic Solution with Heavy Metals	Pickle Liquor Rinse Water	9074.8	1240.8	10315.6	3.3
112	Acidic Solution with Other Metals and Non-Metals	Demineralizer Regenerent	476.2	158.7	634.9	0.2
113	Other Acidic Solutions	Boiler Stack Scrubber Water with Dilute Carbonic Acid (H_2CO_3)	8072.1	43.6	8115.7	2.6
12 ALKALINE SOLUTIONS						
121	Alkaline Solution with Heavy Metals	Rinse Waters from Surface Cleaning of Metals	7198.0	584.4	7782.4	2.5
122	Alakaline Solution with Other Metals	Demineralizer regenerent	132.0	0.0	132.0	<.1
123	Other Alkaline Solutions	Cleanup Water from Lime or Cement Kiln	5738.0	982.5	6720.5	2.1

TABLE 10

SURVEYED WASTE QUANTITIES BY UCD CATEGORIES (continued)

(tonnes per year)

UCD WASTE	DESCRIPTION	TYPICAL WASTES	1st 500 SURVEY	2nd 500 SURVEY	TOTAL SURVEY	% OF TOTAL
13 METAL FINISHING SOLUTIONS						
131	Metal Finishing Solutions, Acid	Ammonia Based, Containing Copper, Tin, Lead, Cadmium or Chromium	114.2	573.4	687.6	0.2
132	Metal Finishing Solutions, Alkaline	Contains Strong Complexing Agent and Copper, Tin, Lead and/or Cadmium	49.0	98.5	147.5	<.1
133	Spend Pickle Liquor from Ferrous and Non Ferrous Metals	Strong Acids with Iron, Fluoride, Hydrochloric Acid (HCl), Sulfuric Acid (H_2SO_4), Nitric Acid (HNO_3)	321.4	1172.3	1493.7	0.5
14 OTHER AQUEOUS SOLUTIONS						
141	Aqueous Solutions with Heavy Metals	Cleaning Solutions from Tanks, Trucks, or Railroad Tankers	9250.9	2121.0	11371.9	3.6
142	Aqueous Solutions with Other Metals	Rinse Water from Heat Treating Salt Baths, Contain Barium, Aluminum	0.0	0.0	0.0	0.0
143	Aqueous Solutions with Reactive Anions	Bleaching Solutions Containing Sulfite, Chlorite, Fluoride, Bromate	8368.8	0.0	8368.8	2.7
145	Brine	Salt Solutions After Neutralization or Chlor/Alkali Production	18.1	0.0	18.1	<.1
146	Solutions Containing Cyanide	Plating Baths	2.0	4.9	6.9	<.1
147	Solutions Containing Sulfides	Plating Baths	0.0	0.0	0.0	0.0

TABLE 10

SURVEYED WASTE QUANTITIES BY UCD CATEGORIES (continued)

(tonnes per year)

UCD WASTE	DESCRIPTION	TYPICAL WASTES	1st 500 SURVEY	2nd 500 SURVEY	TOTAL SURVEY	% OF TOTAL
15 INORGANIC SOLIDS						
151	Inorganic Solids	Foundry Sand with Phenolics	19866.5	46136.4	66002.9	21.1
152	Inorganic Solid Chemicals	Aged or Off Spec. Chemicals Including Lime, Caustic Soda and Partial Containers of Laboratory Size	186.3	1672.6	1858.9	0.6
16 OTHER INORGANIC WASTES						
165	Spent Catalyst	Maybe Carbon or Metal	121.2	90.7	211.9	0.1
167	Other Inorganic Waste	Ash and Construction Residue	3668.8	871.7	4540.5	1.4
21 SPENT SOLVENTS						
211	Halogenated Solvents with Heavy Metals	Methylene Chloride, 1, 1, 1, Trichloroethylene Used for Metal Cleaning	39.1	101.6	140.7	<.1
212	Halogenated Solvents with Other Metals	Surface Cleaning and Degreasing Solvents	0.8	167.7	168.5	0.1
213	Other Halogenated Solvents	Freon with Other Solvents Used in Chemical Processing	39.4	15.7	55.1	<.1
214	Non-Halogenated Solvents with Heavy Metals	Toluene, Benzene, Xylene Contaminated with Catalysts	8.6	101.3	109.9	<.1

TABLE 10

SURVEYED WASTE QUANTITIES BY UCD CATEGORIES
(continued)

(tonnes per year)

UCD WASTE	DESCRIPTION	TYPICAL WASTES	1st 500 SURVEY	2nd 500 SURVEY	TOTAL SURVEY	% OF TOTAL
215	Non-Halogenated Solvents with Other Metals	Acetone, Methylisobutylketone (MIBK) used in Paint and Varnish Formulation	84.8	399.4	484.2	0.2
216	Other Non-Halogenated Solvents	Methylethylketone and Other Solvents Contaminated with Dirt	2416.5	1143.3	3559.8	1.1
217	Unspecified Solvents	Alcohols and Mixtures of Solvents	270.7	659.9	930.6	0.3
22 OTHER ORGANIC LIQUIDS						
221	Organic Liquids with Metals and Halogens	Dyes	0.0	0.0	0.0	0.0
222	Organic Liquids with Halogens Only	Chloroform, Carbon Tetrachloride	0.0	0.0	0.0	0.0
223	Organic Liquids with Metals Only	Nickelcarbonyl, Methyl Mercury	0.2	0.0	0.2	<.1
224	Other Organic Liquids	Creosote and Other Poly Aromatic Hydrocarbons	3244.8	197.3	3442.1	1.1
225	Aqueous Solution with Non-Halogenated Residues Less Than 10%	Laboratory Mixtures	261.4	2852.5	3113.9	1.0
226	Aqueous Solutions with Halogenated Residues Less Than 10%	Waste or Rinse Waters After Degreasing	0.0	0.0	0.0	0.0

TABLE 10

SURVEYED WASTE QUANTITIES BY UCD CATEGORIES (continued)

(tonnes per year)

UCD WASTE	DESCRIPTION	TYPICAL WASTES	1st 500 SURVEY	2nd 500 SURVEY	TOTAL SURVEY	% OF TOTAL
227	Aqueous Solution with Non-Halogenated Organic Residue Greater Than 10%	Laboratory Mixtures	14.5	272.4	286.9	0.1
228	Aqueous Solution with Halogenated Organic Residue Greater Than 10%	Wash or Rinse Waters after Degreasing	0.0	0.0	0.0	0.0
24 - 25 OTHER ORGANIC WASTES						
241	Pesticides and Wastes	Partial Containers, Tank Washings, Off Spec. Product, etc.	13.2	12.3	25.5	<.1
242	PCB Oils and High Strength (over 500 ppm) Liquids	From Transformers and Capacitors	13.2	9.6	22.8	<.1
243	Pharmaceuticals and Wastes	Off-Spec. Drugs, Cleanup Waters, etc. Includes Items such as Vitamins	61.2	0.3	61.5	<.1
244	Photochemical Waste	Most Solutions Non-Toxic Except those with Silver	41.3	4.2	45.5	<.1
245	Off-Spec or Aged Organics	Can Include Solids or Liquids. Generally in Containers	147.6	998.3	1145.9	0.4
247	Halogenated Still Bottoms	Spent Solvent or Waste Oil Recovery	0.0	9.3	9.3	<.1

TABLE 10

SURVEYED WASTE QUANTITIES BY UCD CATEGORIES (continued)

(tonnes per year)

UCD WASTE	DESCRIPTION	TYPICAL WASTES	1st 500 SURVEY	2nd 500 SURVEY	TOTAL SURVEY	% OF TOTAL
248	Non-Halogenated Still Bottoms	Solvent Recovery Operations	1382.4	207.6	1590.0	0.5
251	Tannery Wastes - Liquid	Solutions with Hexavalent Chromium.	0.0	1133.8	1133.8	0.4
252	Solid or Sludge Tannery Wastes	Leather Shavings with Chrome,	4189.4	2819.2	7008.6	2.2
254	Adhesives or Glue	Waste Glues Mostly Aqueous. Some with Phenols	74.9	14.6	89.5	<.1
257	Phenolic Wastes	Phenolic Oil. Tuluene Diisocyanide Residue	1829.3	12866.6	14695.9	4.7
258	Waste Tar and Residues		1396.8	4149.6	5546.4	1.8
26 POLYMERIC MATERIAL WASTES						
261	Polymeric Resin	Polyester, Urethane, Etc.	2909.1	486.3	3395.4	1.1
262	Latex Wastes	Cleanup Water, Paint, Latex and Acrylic Resins	815.8	354.8	1170.6	0.4
263	Other Polymeric Wastes	Kettle Bottoms, Thermoplastic Resins,	742.7	726.4	1469.1	0.5
264	Thermoset Wastes	Urea-Formaldehyde and Thermoset Wastes	0.0	108.8	108.8	<.1

TABLE 10

SURVEYED WASTE QUANTITIES BY UCD CATEGORIES (continued)

(tonnes per year)

UCD WASTE	DESCRIPTION	TYPICAL WASTES	1st 500 SURVEY	2nd 500 SURVEY	TOTAL SURVEY	% OF TOTAL
28 OILY WASTES						
281	Waste Oil and Mixed Oil	Used Automotive Oil, Hydraulic Oil, Cutting Oil - May Contain Solvents or Metals	1233.8	1929.2	3163.0	1.0
282	Oily Tank Bottoms	Crude Oil or Sludge from Storage	389.6	17.6	407.2	0.1
283	Oily Mud, Sediment and Water	Crude Oil Tanker Cleaning	980.0	1999.0	2979.0	1.0
284	Oily Acidic Solids	Solids from Emulsion Breaking and Re-Refining	0.0	21768.0	21768.0	6.9
285	Oily Alkaline Solids	Refining Solids	0.0	0.2	0.2	<.1
286	Oil/Water Separator Sludge	Oil Cooled Heavy Inorganics	3.2	0.0	3.2	<.1
288	Oily Wastes with Heavy Metal Contaminants	Steel Rolling Mill Sludges and Mill Scale	2761.1	7.6	2768.7	0.9
289	Oily Wastes with Water	Emulsions, Cleanup Water from Garages, Cooling Waters	16892.5	20625.4	37517.9	12.0
41 RELATIVELY INERT SLUDGES						
416	Ink Sludge	Sludge Could Contain Solvents, and Lead, Cesium, Chromium	35.0	148.0	183.0	0.1
417	Alum and Gypsum Sludges	Waste Water Phosphate. Removal Sludge	0.0	0.0	0.0	0.0

TABLE 10

SURVEYED WASTE QUANTITIES BY UCD CATEGORIES (continued)

(tonnes per year)

UCD WASTE	DESCRIPTION	TYPICAL WASTES	1st 500 SURVEY	2nd 500 SURVEY	TOTAL SURVEY	% OF TOTAL
43 METAL SLUDGES						
431	Heavy Metal Sludge	Similar to that in 111, 113, 121, 123, 132, 133, 141,	7840.1	1055.5	8895.6	2.8
433	Other Metal Sludges	Ferric Chloride, Aluminum Oxide, etc.	47.2	2446.4	2493.6	0.8
44 - 45 OTHER SLUDGES						
441	Lime Sludges	From Treatment of Acids and Similar to 431 and Derived from 111, 113, 121, 123, 131, 132, 133, 141	20078.3	5788.4	25866.7	8.3
443	Sulfur Sludge	Desulfurization of Flue Gas Non-reactive but Very Low Bearing Strength	4.5	0.9	5.4	<.1
444	Cyanide Bearing Sludge	Pot Liners from Aluminum Reduction and Scrubber Sludge from Blast Furnace	19.3	17.5	36.8	<.1
445	Plating or Metal Finishing Sludge	Derived Mostly from 131, 132, 133	598.9	890.5	1489.4	0.5
446	Degreasing Sludge	Grease and Oily Soil Containing Trichloroethane (TCE)	75.2	67.2	142.4	<.1
447	Tetraethyl Lead Sludge	Tank Bottoms	3.7	0.0	3.7	<.1

TABLE 10

SURVEYED WASTE QUANTITIES BY UCD CATEGORIES
(continued)

(tonnes per year)

UCD WASTE	DESCRIPTION	TYPICAL WASTES	1st 500 SURVEY	2nd 500 SURVEY	TOTAL SURVEY	% OF TOTAL
454	Paint Sludge	Drum Bottoms, Spills, Cleanup, etc.	1628.3	291.6	1919.9	0.6
455	Paint Sludge Without Heavy Metals	Mostly Latex	419.4	0.0	419.4	0.1
50 - 53 MISCELLANEOUS						
509	Gas Cylinders or Containers	Oxygen Cylinders - Empty	0.0	0.0	0.0	0.0
512	Spill Cleanup	Oil/Soil Mixture	461.6	450.3	911.9	0.3
513	Laboratory Waste Chemicals	Partially Full Small Containers	8.9	7.0	15.9	<.1
518	Dust Collector Wastes	Dry Lime from Dust Control Baghouse	1315.9	22788.8	24104.7	7.7
521	Spent Cartridge Filters	Air Cleaning Filters on Ventilation System	7.3	10.5	17.8	<.1
523	Tank Bottom Sediments		43.8	0.1	43.9	<.1
528	Pathogenic Wastes	Used Bandages, Dressings	0.0	0.0	0.0	0.0
529	Explosive Wastes		0.0	0.0	0.0	0.0
531	Contaminated Rags	Cleanup Materials	1.2	3.9	5.1	<.1
532	Equipment and/or Containers Contaminated with Pesticides	Empty Pesticide Cans	0.0	40.8	40.8	<.1
		TOTALS	147504.6	165919.0	313423.5	

TABLE 11

WASTE QUANTITIES SURVEYED BY OWMC CLASSES

OWMC CLASS NO.	DESCRIPTION OF WASTE CLASS	UCD CODES	QUANTITIES (tonnes)			% OF TOTAL
			FIRST 500 SURVEY	SECOND 500 SURVEY	TOTAL SURVEY	
1	Organic Sludges & Still Bottoms	247, 248, 261, 252, 523, 263, 257, 446, 529	11 171.9	17 182.7	28 354.6	9.1
2	Solvents & Organic Solutions	211, 212, 213, 214, 215, 216, 217, 221, 222, 223, 224	6 104.9	2786.2	8891.1	2.8
3	Oils & Greases	281	1 233.8	1 929.2	3 163.0	1.0
4	Oil/Water Mixtures	283	980.0	1 999.0	2 979.0	1.0
5	Organic & Oily Residuals	264, 282 284, 285 286, 288 289, 447	20 050.1	42 527.8	62 577.9	20.0
6	Heavy Metal Solutions & Residuals	111, 112 113, 121 122, 123 131, 132 133, 141 142, 143 244, 251 431, 433 445	57 322.7	12 505.6	69 828.3	22.3
7	Miscellaneous Chemicals & Products	145, 152, 243, 245, 416, 513	457.1	2 826.0	3 283.1	1.0
8	Paint and Organic Residuals	254, 258, 262, 454, 455	4 335.1	4 810.7	9 145.8	2.9
9	Aqueous Solutions with Organics	225, 226, 227, 228	276.0	3 124.9	3 400.9	1.1
10	Anion Complexes	146, 147 444	21.3	22.4	43.7	.0
11	Sludges & Inorganic Residuals	151, 165, 167, 417, 441, 443, 518, 509	45 055.2	75 677.0	120 732.2	38.5
12	Pesticide & Herbicide Wastes	241, 532	13.2	53.1	66.2	.0
13	PCB Wastes	242	13.2	9.6	22.8	.0
14	Clean-Up Residuals	512, 521, 528, 531	470.1	464.8	934.9	0.3
		TOTALS	147 504.6	165 919.0	313423.5	100

CHAPTER 4

EXTRAPOLATION OF SAMPLE WASTE GENERATION DATA TO ONTARIO

In this chapter, the results of special waste generation extrapolations for the 1st 500 survey and the combined 1000 establishment survey are presented.

4.1 TOTAL WASTE QUANTITIES

The results of the 1st 500 and total 1000 establishment surveys were used to estimate the total special waste generated in Ontario. The extrapolation procedures were described in Chapter 2. Calculations were made of the mean waste production and variance for each of the 98 (SIC x establishment size) strata using equations 1 and 2. The overall mean waste generation and variance were calculated using Equations 3 and 4. Note that the extrapolations were carried out utilizing the mean waste generation per sampled establishment. Confidence intervals were computed using the appropriate value of Student's "t" and the calculated degrees of freedom.

The two extrapolations carried out for the 1st 500 survey and the combined 1000 establishment survey are presented in Table 12.

TABLE 12

EXTRAPOLATED WASTE GENERATION FOR ONTARIO MANUFACTURING ESTABLISHMENTS FOR 500 AND 1000 SURVEY DATA

SURVEY DATA	WASTE GENERATION (tonnes per year x 10^3)	90% CONFIDENCE INTERVALS (tonnes per year x 10^3)
First 500	1690	± 680
Combined 1000	1350	± 300

The confidence intervals for the 1000 establishment data set, as might be expected for the large sample size, are reduced by more than 40 percent when compared to the 500 establishment confidence intervals.

Establishments with ten or fewer employees were estimated to generate only 44 800 tonnes or 3.3% of the total annual waste quantity. Over 80% of the small establishment generation is due to the SIC 28 and 33 sectors (Table 13).

As pointed out previously and based on a comparison between actual survey data and D & B data listed for the surveyed establishments, there are some deficiencies in the D & B data base which may impact the special waste extrapolations; ie.

1) About 4.5% of the D & B establishments were determined to be out of business.

2) About 10% of the D & B establishments were non-manufacturing.

3) About 37% of the listed D & B establishments are misclassified with respect to SIC.

4) New (after 1983) establishments are not listed in D & B. In addition some establishments listed as non-manufacturing may, in fact, be involved in manufacturing.

TABLE 13

EXTRAPOLATED SPECIAL WASTE QUANTITIES FOR 1000 SURVEY BY SIC ($t/a \times 10^3$)

SIC	DESCRIPTION*	ESTABLISHMENTS ≤10 EMPLOYEES	ESTABLISHMENTS >10 EMPLOYEES	WASTE QUANTITY TOTAL	% OF TOTAL
16	Construction	0.4	0.3	0.7	0.1
20	Food & Kindred Prod.	0.0	84.7	84.7	6.4
22	Textile Mill Prod.	0.0	2.3	2.3	0.2
23	Apparel	0.0	<.1	<.1	<.1
24	Lumber & Wood	0.6	0.5	1.1	0.1
25	Furniture & Fixtures	0.1	2.3	2.4	0.2
26	Paper Products	0.2	70.3	70.5	5.3
27	Printing & Publishing	0.8	2.4	3.2	0.2
281	Inorganic Chemicals	1.3	71.7	73.0	5.5
282	Plastic & Synthetics	3.0	37.7	40.7	3.1
283	Biological Products	0.0	3.0	3.0	0.2
284	Soaps, Detergents, etc.	0.4	25.7	26.1	2.0
285	Paints & Varnishes	0.3	9.7	10.0	0.8
286	Ind. Organic Chem.	<.1	38.4	38.4	2.9
287	Fertilizers	0.1	5.6	5.7	0.4
289	Adhesives & Sealants, etc.	3.6	7.9	11.5	0.9
29	Petroleum	0.1	128.9	129.0	9.7
30	Rubber & Plastics	0.4	32.6	33.0	2.5
31	Leather Products	<.1	59.4	59.4	4.5
32	Stone, Clay, Glass & Concrete	1.2	114.4	115.6	8.7
331	Steel	25.9	104.5	130.4	9.8
332	Foundries	1.5	107.7	109.2	8.2
333	Prim Smelting (non-ferrous)	0.0	27.5	27.5	2.1
334	Sec. Smelting (non-ferrous)	<.1	71.5	71.5	5.4
335	Rolling & Draw (non-ferrous)	0.0	4.4	4.4	0.3
336	Non-ferrous Casting	<.1	54.9	54.9	4.1
339	Heat Treating	<.1	0.5	0.5	<.1
341	Cans & Containers	0.0	2.2	2.2	0.2
342	Tools & Hardware	<.1	2.9	2.9	0.2
343	Plumbing & Heat Equip.	<.1	0.6	0.6	<.1
344	Metal Work. Equip.	0.1	2.9	3.0	0.2
345	Screws & Bolts, etc.	<.1	1.1	1.1	0.1
346	Forging & Stampings	0.0	3.5	3.5	0.3
347	Electroplating	1.1	18.4	19.5	1.5
348	Arms & Ammo.	0.0	0.0	0.0	0.0
349	Springs & Valves	<.1	16.0	16.0	1.2
351	Turbines & Engines	0.1	0.6	0.7	<.1
352	Farm Equip.	0.0	14.0	14.0	1.1
353	Construction Equip., etc.	0.5	1.3	1.8	0.1
354	Tools & Dies	3.2	0.1	3.3	0.2
355	Manufacturing Equip., etc.	0.0	0.2	0.2	<.1
356	Bearings, etc.	<.1	0.7	0.7	0.1
357	Electronic Equip	<.1	0.5	0.5	0.0
358	Automatic Machines	0.0	0.9	0.9	0.1
359	Carburetors, etc.	0.1	0.3	0.3	<.1
36	Elec. & Electronic Mach.	0.3	19.0	19.3	1.4
37	Transportation Equip.	0.2	125.0	125.2	9.4
38	Measuring etc. Instrum.	<.1	0.2	0.2	<.1
39	Misc. Manufacturing	0.0	4.3	4.3	0.3
	TOTALS	45.4	1283.5	1328.9 *	100.0

* Rounded to 1350

The first two factors would suggest that the special waste quantities estimated herein for Ontario may be somewhat higher than the actual values. On the other hand, the fourth factor would suggest a higher value for special waste generation. It is difficult to estimate what impact the third factor may have on waste quantities. In order to improve the accuracy of future extrapolations it is recommended that further effort be devoted to population data base verification and using alternative population data bases (eg. Statistics Canada data).

4.2 WASTE GENERATION BY SIC

The extrapolated waste generation based on the 1000 survey data and broken down by two and three digit SIC is presented in Table 13. The major contributors by industrial sector were as follows:

	tonnes per year x 10^3	% of Total
1) SIC 33 - Primary Metal	398	30.0
2) SIC 28 - Chemical	208	15.7
3) SIC 29 - Petroleum	129	9.7
4) SIC 37 - Transportation	125	9.4
5) SIC 32 - Glass, etc.	116	8.7
6) SIC 20 - Food and Kindred Products	85	6.4
7) SIC 26 - Paper Products	71	5.3
8) SIC 34 - Fabricated Metal	49	3.7
	1181	88.9

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Previous chapters of this report describe the background, objectives and procedures which resulted in the development of a comprehensive data base on special waste for 1000 Ontario manufacturing establishments which can be utilized by OWMC in their facilities planning and waste management processes. In addition, selected analyses and extrapolations were carried out on the data base. Conclusions and recommendations arising from the project implementation and data analyses are summarized in this chapter.

5.1 CONCLUSIONS

Project conclusions and findings are:

1) A computer program specifically written for this survey enables searches and analyses to be carried out on the composite data compiled from the 1000 establishments. The program also has data editing and viewing options and is readily expandable to accommodate the increased data that may result from future sampling programs. Searches and analyses of the data base can be performed for any specific parameter or combination (up to 40) of parameters.

2) Extrapolation of the sample data to the Ontario manufacturing sector as a whole resulted in projections of the total special waste generation for the Province. Separate projections were made using the 1st 500 establishment survey data and the combined 1000 establishments data. Ninety (90) percent confidence intervals were calculated for each extrapolation. The extrapolated values and confidence intervals were:

SURVEY DATA	TOTAL WASTE GENERATION ($t/a \times 10^3$)	90% CONFIDENCE INTERVALS ($t/a \times 10^3$)
First 500	1690	± 680
Combined 1000	1350	± 300

Due to the larger sample size and the narrower confidence intervals, the extrapolation for the 1000 establishment data is considered to be most representative of the Ontario situation as a whole.

3) Less than 50 000 t/a or 3.9 percent of the extrapolated total waste generation is attributed to establishments with 10 or less production employees.

4) The main 2 digit SIC categories contributing to the extrapolated waste production were:

	$t/a \times 10^3$	% of Total
a) SIC 33 - Primary Metal	398	30.0
b) SIC 28 - Chemical	208	15.7
c) SIC 29 - Petroleum	129	9.7
d) SIC 37 - Transportation	125	9.4
e) SIC 32 - Glass, etc.	116	8.7
f) SIC 20 - Food and Kindred Products	85	6.4
g) SIC 26 - Paper Products	71	5.3
h) SIC 34 - Fabricated Metal	49	3.7

5.2 RECOMMENDATIONS

The following recommendations for upgrading or further utilization of the data base are made:

1. In order to account for special wastes generated by operations not encompassed by the 49 SIC categories of this survey (eg. certain commercial and service activities such as rail and truck tank cleaning operations, boiler cleaning operations, commercial laboratories and others), a survey of a representative sample of these types of facilities should be undertaken.

2. The 1000 establishment data base could be used by OWMC, in conjunction with other OWMC studies, as input to:
   a) developing waste characterization and process selection criteria for the design of treatment disposal facilities, and
   b) future efforts to model the quantities and fate of special wastes in Ontario.

3. In order to improve the reliability of special waste generation extrapolations, a better data base of Ontario manufacturing establishments needs to be developed.

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APPENDIX A

UNITED STATES DEPARTMENT OF COMMERCE
STANDARD INDUSTRIAL CLASSIFICATIONS (SIC)

U.S. GOVERNMENT, STATISTICAL
POLICY DIVISION (1972)

UNITED STATES DEPARTMENT OF COMMERCE STANDARD INDUSTRIAL CLASSIFICATIONS (SIC)

SIC	DESCRIPTION
16	CONSTRUCTION OTHER THAN BUILDING CONSTRUCTION - GENERAL CONTRACTORS
1611	Hwy and Street construction excluding elevated highways
1622	Bidge, tunnel and elevated highway construction
1623	Water, sewer, pipe line, comm. & power line construction
1629	Heavy construction, nec.
20	FOOD AND KINDRED PRODUCTS
2011	Meat packing plants
2013	Sausages and prepared meat products
2016	Poultry dressing plants
2021	Creamery butter
2022	Cheese, natural and processed
2023	Condensed and evaporated milk
2024	Ice cream and frozen desserts
2026	Fluid milk
2032	Canned specialties
2033	Canned fruits, vegetables and preserves
2034	Dried and dehydrated fruits, vegetables and soup mixes
2035	Pickled fruits and vegetables, etc.
2037	Frozen fruits, fruit and vegetable juices
2038	Frozen specialties
2041	Flour and other grain mill products
2043	Cereal breakfast foods
2044	Rice milling
2045	Blended and prepared flour
2046	Wet corn milling
2047	Dog, cat and other pet food
2048	Prepared feeds and ingredients for animals and fowls nec.
2051	Bread and bakery products, excluding cookies
2052	Cookies and crackers
2061	Cane sugar, except refining only
2062	Can sugar refining
2063	Beet sugar
2065	Candy and confectionery products
2066	Chocolate and cocoa products
2067	Chewing gum
2074	Cottonseed oil mills
2075	Soybean oil mills
2076	Vegetable oil, excluding corn, cottonseed and soybean
2077	Animal and marine fats and oils
2079	Edible fats and oils, margarine, etc.
2082	Malt beverages
2083	Malt
2084	Wines, brandy and brandy spirits
2085	Distilled, rectified, blended liquors
2086	Soft drinks and bottled waters
2087	Flavoring extracts and syrups, nec.
2091	Canned and cured fish and seafoods
2092	Fresh or frozen fish and seafoods
2095	Roasted coffee
2097	Manufactured ice
2098	Macaroni, spaghetti, noodles, etc.
2099	Food preparations, nec.
22	TEXTILE MILL PRODUCTS
2211	Broad woven fabric mills, cotton
2221	Broad woven fabric mills, silk and fibre
2231	Broad woven fabric mills, wool
2241	Narrow fabrics all kinds
2251	Women's full and knee length hose
2252	Hosiery, except women's full and knee length
2253	Knit outerwear mills
2254	Knit underwear mills
2257	Circular knit fabric mills
2258	Warp knit fabric mills
2259	Knitting mills, nec.
2261	Finishers broad woven cotton fabrics
2262	Finishers broad woven silks and man-made fibre
2269	Finishers of textiles, nec.
2271	Woven carpets and rugs
2272	Tufted carpets and rugs
2279	Carpets and rugs, nec.
2281	Yarn spinning mills, all fibres
2282	Yarn throwing, twisting, winding mills
2283	Yarn mills, wool, rugs and carpets
2284	Thread mills
2291	Felt goods, except woven and hats
2292	Lace goods

SIC	DESCRIPTION
2293	Paddings and upholstery filling
2294	Processed waste and recovered fibres
2295	Coated fabrics, not rubberized
2296	Tire cord and fabric
2297	Cordage and twine
2299	Textile goods, nec.
23	**APPAREL**
2311	Mens, youths and boys suits, overcoats
2321	Mens, youths and boys shirts ex. work
2322	Mens, youths and boys underwear
2323	Mens, youths and boys neckwear
2327	Mens, youths and boys trousers
2328	Mens, youths and boys work clothing
2329	Mens, youths and boys clothing, nec.
2331	Womens, misses and jrs. blouses, shirts
2335	Womens, misses and jrs. dresses
2337	Womens, misses and jrs. suits, coats, skirts
2339	Womens, misses and jrs. outerwear, nec.
2341	Womens, misses and jrs. infacts underwear
2342	Brassieres and allied garments
2351	Millinery
2352	Hats and caps, except millinery
2361	Childrens and girls dresses, shirts
2363	Girls, childrens, coats and suits
2369	Girls, childrens, outerwear, nec.
2371	Fur goods
2381	Gloves, ex. knit and leather
2384	Robes and dressing gowns
2385	Raincoats and waterproof outer garments
2386	Leather and sheep lined clothing
2387	Apparel belts
2389	Apparel and accessories, nec.
2391	Curtains and draperies
2392	Housefurnishings, ex. curtains, drapes
2393	Textile bags
2394	Canvas and related products
2395	Pleating and stitching for the trade
2396	Auto trimmings, apparel findings etc.
2397	Schiffli machine embroideries
2399	Fabricated textile products, nec.
24	**LUMBER AND WOOD PRODUCTS**
2411	Logging camps and contractors
2421	Sawmills and planing mills, general
2426	Hardwood dimensions and flooring mills
2429	Special product sawmills, nec.

SIC	DESCRIPTION
2431	Millwork
2434	Wood kitchen cabinets
2435	Hardwood veneer and plywood
2436	Softwood veneer and plywood
2439	Structural wood members, nec.
2441	Nailed and lock corner wood boxes and shook
2448	Wood pallets and skids
2449	Wood containers, nec.
2451	Mobile homes
2452	Prefab wooden buildings and components
2491	Wood preserving
2492	Particleboard
2499	Wood products, nec.
25	**FURNITURE AND FIXTURES**
2511	Wood household furniture ex. upholstered
2512	Wood household furniture upholstered
2514	Metal household furniture
2515	Mattresses and bedsprings
2517	Wood T.V., radio, cabinets, etc.
2519	Household furniture, nec.
2521	Wood office furniture
2522	Metal office furniture
2531	Public building and furniture
2541	Wood, office and store fixtures
2542	Metal, office and store fixtures
2591	Drapery hardware blinds and shades
2599	Furniture and fixtures, nec.
26	**PAPER PRODUCTS**
2611	Pulp mills
2621	Paper mills, excluding building
2631	Paperboard mills
2641	Paper coating and glazing
2642	Envelopes
2643	Bags, except textile bags
2645	Die-cut paper and cardboard
2646	Pressed and molded pulp goods
2647	Sanitary paper products
2648	Stationery, tablets and rel. products
2649	Converted paper and paperboard products
2651	Folding paperboard boxes
2652	Set-up paperboard boxes
2653	Corrugated and solid fibre boxes
2654	Sanitary food containers
2655	Fibre cans, tubes, drums, etc.
2661	Building paper and building board mills

SIC	DESCRIPTION
27	PRINTING PUBLISHING
2711	Newspapers
2721	Periodicals
2731	Books
2732	Book printing
2741	Miscellaneous publishing
2751	Commercial printing, letterheads and screen
2752	Commercial printing, lithographic
2753	Engraving and plate printing
2754	Commercial printing, gravure
2761	Manifold business forms
2771	Greeting card publishing
2782	Blankbooks, looseleaf binders and devices
2789	Bookbinding and related work
2791	Typesetting
2793	Photoengraving
2794	Electrotyping and stereotyping
2795	Litho platemaking and related services
28	CHEMICALS
2812	Alkalies and chlorine
2813	Industrial gases
2816	Inorganic pigments
2819	Industrial inorganic chemicals, nec.
2821	Plastic materials, synthetic resins
2822	Synthetic rubber
2823	Cellulosic man-made fibres
2824	Synthetic organic fibres, ex. cellulosic
2831	Biological products
2833	Medicinal chemicals and botanical products
2834	Pharmaceutical preparations
2841	Soap and detergents, ex. special cleaners
2842	Spec. cleaners, polishing and sanitation preparations
2843	Surface active agents, sulfonated oils
2844	Perfumes, cosmetics, etc.
2851	Paints, varnishes, etc.
2861	Gum and wood chemicals
2865	Cyclic crudes, dyes and organic pigments
2869	Industrial organic chemicals, nec.
2873	Nitrogenous fertilizers
2874	Phosphatic fertilizers
2875	Fertilizers, mixing only
2879	Pesticides and agric. chemicals, nec.
2891	Adhesives and sealants
2892	Explosives
2893	Printing ink
2895	Carbon black
2899	Chem. and chem. preparations, nec.

SIC	DESCRIPTION
29	PETROLEUM
2911	Petroleum refining
2951	Paving mixtures and blocks
2952	Asphalt felts and coatings
2992	Lubricating oils and greases
2999	Petroleum and coal products, nec.
30	RUBBER AND PLASTICS
3011	Tires and inner tubes
3021	Rubber and plastics footwear
3031	Reclaimed rubber
3041	Rubber and plastics hose and belting
3069	Fabricated rubber products, nec.
3079	Miscellaneous plastics products
31	LEATHER PRODUCTS
3111	Leather tanning and finishing
3131	Boot and shoe cut stock findings
3142	House slippers
3143	Mens footwear, ex. athletic
3144	Womens footwear, ex. athletic
3149	Footwear, ex. rubber, nec.
3151	Leather gloves and mittens
3161	Luggage
3171	Womens handbags and purses
3172	Personal leather goods, ex. pursus
3199	Leather goods, nec.
32	STONE, CLAY, GLASS AND CONCRETE PRODUCTS
3211	Flat glass
3221	Glass containers
3229	Pressed and blown glass, nec.
3231	Glass products made of purchased glass
3241	Cement, hydraulic
3251	Brick and structural clay tile
3253	Ceramic wall and floor tile
3255	Clay refractories
3259	Structural clay products, nec.
3261	Vitreous china plumbing fixtures, etc.
3262	Vitreous china kitchen articles
3263	Fine earthenware kitchen articles
3264	Porcelain electrical supplies
3269	Pottery products, nec.
3271	Concrete block and brick
3272	Concrete products ex. block and brick
3273	Ready-mixed concrete

SIC	DESCRIPTION
33	PRIMARY METAL INDUSTRIES
3312	Blast furnaces and rolling mills
3313	Electrometallurgical products
3315	Steel wire drawing and nail and spikes
3316	Cold rolled steel sheet, bars and strip
3317	Steel pipe and tubes
3321	Gray iron foundries
3322	Malleable iron foundries
3324	Steel investment foundries
3325	Steel foundries, nec.
3331	Primary smelting and refining of copper
3332	Primary smelting and refining of lead
3333	Primary smelting and refining of zinc
3334	Primary production of aluminum
3339	Prim. smelting and refining non ferrous metals, nec.
3341	Sec. smelting and refining non ferrous metals
3351	Rolling, drawing and extruding of copper
3353	Aluminum sheet, plat and foil
3354	Aluminum extruded products
3355	Aluminum rolling and drawing, nec.
3356	Roll, draw, extr. non ferrous metals except copper and aluminum
3357	Drawing and insulating of non ferrous wire
3361	Aluminum castings
3362	Brass, bronze and copper castings
3369	Non ferrous castings, nec.
3398	Metal heat treating
3399	Primary metal products, nec.
34	FABRICATED METAL PRODUCTS
3411	Metal cans
3412	Metal shipping barrels, drums, kegs, etc.
3421	Cutlery
3423	Hand and edge tools, excluding saws and machine tools
3425	Hand saws and saw blades
3429	Hardware, nec.
3431	Enameled iron and metal sanitary ware
3432	Plumbing fixture fittings brass goods
3433	Heating equipment, except electric and warm air furnace
3441	Fabricated structural metal
3442	Metal doors, sash, frames, etc.
3443	Fabricated plate work-boilers
3444	Sheet metal work
3446	Architectural and ornamental metal work
3448	Prefabricated metal buildings and components
3449	Miscellaneous metal work
3451	Screw machine products
3452	Bolts, nuts, screws, rivets and washers
3462	Iron and steel forgings
3463	Non ferrous forgings
3465	Automotive stampings
3466	Crowns and closures
3469	Metal stampings, nec.
3471	Electroplating, polishing and coloring
3479	Coating, engraving and allied services, nec.
3482	Small arms ammunition
3483	Ammunition, except small arms, nec.
3484	Small arms
3489	Ordinance and accessories, nec.
3493	Steel springs, except wire
3494	Valves and pipe fittings, except plumbers brass good
3495	Wire springs
3496	Miscellaneous fabricated wire products
3497	Metal foil and leaf
3498	Fabricated pipe and pipe fittings
3499	Fabricated metal products, nec.
35	MACHINERY, EXCEPT ELECTRICAL
3511	Steam, gas, hydraulic turbines
3519	Internal combustion engines, nec.
3523	Farm machinery and equipment
3524	Garden tractors and equipment
3531	Construction machinery and equipment
3532	Mining machiner and equipment, except oil
3533	Oil field machinery and equipment
3534	Elevators and moving stairways
3535	Conveyors and conveying equipment
3536	Hoists, industrial cranes, etc.
3537	Industrial trucks, tractors, etc.
3541	Machine tools, metal cutting types
3542	Machine tools, metal forming types
3544	Special dies and tools
3545	Machine tool accessories
3546	Power driven hand tools
3547	Rolling mill machinery and equipment
3549	Metalworking machinery, nec.
3551	Food products machinery
3552	Textile machinery
3553	Woodworking machinery

SIC	DESCRIPTION
3554	Paper industries machinery
3555	Printing trades machinery and equipment
3559	Special industry machinery, nec.
3561	Pumps and pumping equipment
3562	Ball and roller bearings
3563	Air and gas compressors
3564	Blowers and exhaust fans
3565	Industrial patterns
3566	Speed changers, drives and gears
3567	Industrial process furnaces
3568	Mechanical power trans. equipment, nec.
3569	General industrial machinery equipment, nec.
3572	Typewriters
3573	Electronic computing equipment
3574	Calc. and acct. machinery except computers
3576	Scales and balances, except laboratories
3579	Office machines, nec.
3581	Automatic merchandising machines
3582	Comml. laundry and dry cleaning machines
3585	Air conditioning and refrig. and warm air heating equipment
3586	Measuring and dispensing pumps
3589	Service industry machines, nec.
3592	Carburetors, pistons, valves
3599	Machinery, except electrical, nec.
36	ELECTRICAL AND ELECTRONIC MACHINERY
3612	Power, dist. and spec. transformers
3613	Switching and switchboard apparatus
3621	Motors and generators
3622	Industrial controls
3623	Welding apparatus, electric
3624	Carbon and graphite products
3629	Electrical indus. apparatus, nec.
3631	Household cooking equipment
3632	Household refrigerators and freezers
3633	Household laundry equipment
3634	Electric housewares and fans
3635	Household vacuum cleaners
3636	Sewing machines
3639	Household appliances, nec.
3641	Electric lamps
3643	Curren-carrying wiring devices
3644	Noncurrent-carrying wiring devices
3645	Residential elect. lighting fixtures
3646	Comm. indust. electricl lighting fixtures
3647	Vehicular lighting equipment
3648	Lighting equipment, nec.
3651	Radio and T.V. rec. sets, except commun.
3652	Phonograph records and pre recorded tapes
3661	Telephone and telegraph appratus
3662	Radio and TV transmitting equipment, etc.
3671	Radio and TV tubes, except cathode
3672	Cathode ray picture tubes
3673	Transmit. indust. and spec. electron tubes
3674	Semiconductors and related devices
3675	Electronic capacitors
3676	Resistors, electronic applications
3677	Electronic coils, transformers, etc.
3678	Connectors, for electronic applications
3679	Electronic components, nec.
3691	Storage batteries
3692	Primary batteries, dry and wet
3693	Therapeutic X-Ray tubes, etc.
3694	Elec. equip. internal combustion engines
3699	Electric machinery, equip. supplies, nec.
37	TRANSPORTATION EQUIPMENT
3711	Motor vehicles and passenger car bodies
3713	Truck and bus bodies
3714	Motor vehicle parts and accessories
3715	Truck trailers
3721	Aircraft
3724	Aircraft engines and engine parts
3728	Aircraft parts and auxiliary equipment, nec.
3731	Ship building and repairing
3732	Boat building and repairing
3743	Railroad equipment
3751	Motorcycles, bicycles and parts
3761	Guided missiles and space vehicles
3792	Travel trailers and campers
3795	Tanks and tank components
3799	Transportation equipment, nec.
38	MEASURING, ANALYZING AND CONTROLLING INSTRUMENTS
3811	Scientific and research instr. and equipment
3822	Automatic temperature controls
3823	Indus. control instruments for measurement
3824	Totalizing fluid meters and count devices
3825	Electrical measuring testing equipment

SIC	DESCRIPTION
3829	Measuring and controlling devices, nec.
3832	Optical instruments and lenses
3841	Surgical and medical instruments
3842	Orthopedic and prosthetic appliances
3843	Dental equipment and supplies
3851	Ophthalmic goods
3861	Photographic equipment and supplies
3873	Watches, clocks, etc.
39	MISCELLANEOUS MANUFACTURING INDUSTRIES
3911	Jewelry, precious metal
3914	Silverware, plated ware, etc.
3915	Jewelers findings and materials
3931	Musical instrucments
3942	Dolls
3944	Game, toys and childrens veh. ex. dolls and bicycles
3949	Sporting and athletic goods, nec.
3951	Pens, mech. pencils, etc.
3952	Lead pencils, crayons, etc.
3953	Marking devices
3955	Carbon paper and inked ribbons
3961	Costume jewelry
3962	Feathers, artificial flowers
3963	Buttons
3964	Needles, pins, hooks, eyes and notions
3991	Brooms and brushes
3993	Signs and advertising displays
3995	Burial caskets
3996	Linoleum and other floorings, nec.
3999	Manufacturing industries, nec.
42	MOTOR FREIGHT TRANSPORTATION AND WAREHOUSING
4213	Trucking, except local
4214	Local trucking and storage
4221	Farm product warehousing and storage
4222	Refrigerated warehousing
4224	Household goods warehousing and storage
4225	General warehousing and storage
4226	Special warehousing and storage, nec.
4231	Maintenance facil. motor freight trans.

SIC	DESCRIPTION
45	TRANSPORTATION BY AIR
4511	Air transportation, certified carriers
4521	Air transportation, noncertified carriers
4582	Airports and flying fields
4583	Airport terminal services
49	ELECTRIC, GAS AND SANITARY SERVICES
4911	Electric services
4922	Natural gas transmission
4923	Natural gas transmission and distribution
4924	Natural gas distribution
4925	Mixed m'f'g or liquified petro gas production
4931	Electric and other services combined
4932	Gas and other services combined
4941	Water supply
4952	Sewerage systems
4953	Refuse systems
4959	Sanitary services, nec.
4961	Steam supply
4971	Irrigation systems
50	WHOLESALE TRADE - DURABLE GOODS
5012	Autos and other motor vehicles
5013	Auto parts and supplies
5014	Tires and tubes
5021	Furniture
5023	Home furnishings
5031	Lumber, plywood and millwork
5039	Construction materials, nec.
5041	Sporting and rec. goods and supplies
5042	Toys and hobby goods and supplies
5043	Photo equipment and supplies
5051	Metals service centres and offices
5052	Coal, minerals and ores
5063	Electrical equipment and supplies
5064	Electrical appliances, TV and radio
5065	Electronic parts and equipment
5072	Hardware
5074	Plumbing and heating equipment and supplies
5075	Warm air heating and air conditioning equipment
5078	Refrigeration equipment and supplies
5081	Commercial machines and equipment
5082	Construction and mining machinery and equipment

SIC	DESCRIPTION
5083	Farm and garden machinery and equipment
5084	Industrial machinery and equipment
5085	Industrial supplies
5086	Professional equipment and supplies
5087	Service estab. equipment and supplies
5088	Transportation equipment and supplies, except motor vehicles
5093	Scrap and waste materails
5094	Jewelry, watches, diamonds and other precious stones
5099	Durable goods, nec.
51	WHOLESALE TRADE - NONDURABLE GOODS
5111	Printing and writing paper
5112	Stationery supplies
5113	Industrial and personal service paper
5122	Drugs, drug proprietaries, etc.
5133	Piece goods woven fabrics
5134	Notions and other dry goods
5136	Mens and boys clothing and furnishings
5137	Womens, childrens clothing and accessories
5139	Footwear
5141	Groceries, general line
5142	Frozen foods
5143	Dairy products
5144	Poultry and poultry products
5145	Confectionery
5146	Fish and seafoods
5147	Meats and meat products
5148	Fresh fruits and vegetables
5149	Groceries and related products, nec.
5152	Cotton
5153	Grain
5154	Livestock
5159	Farm-product raw materials, nec.
5161	Chemicals and allied products
5171	Petroleum bulk stations and terminals
5172	Petrol and petrol products except bulk stat. and terminals
5181	Beer and ail
5182	Wines anc distilled alcoholic beverages
5191	Farm supplies
5194	Tobacco and tobacco products
5198	Paints, varnishes and supplies
5199	Nondurable goods, nec.

SIC	DESCRIPTION
55	AUTO DEALERS AND GASOLINE STATIONS
5511	Motor vehicle dealers - new and used
5521	Motor vehicle dealers - used
5531	Auto and home supply stores
5541	Gasoline service stations
5551	Boat dealers
5561	Recreational and utility trailer dealers
5571	Motorcycle dealers
5599	Automotive dealers, nec.
58	EATING AND DRINKING PLACES
5812	Eating places
5813	Drinking places - alcoholic beverages
72	PERSONAL SERVICES
7211	Power laundries
7212	Garment pressing and agent for laundries
7213	Linen supply
7214	Diaper service
7215	Coin-operated laundries
7216	Dry cleaning, except rug
7217	Carpet and upholstery cleaning
7218	Industrial launderers
7219	Laundry and garment services, nec.
7221	Photo studios
7231	Beauty shops
7241	Barber shops
7251	Shoe repair shops
7261	Funeral service and crematories
7299	Miscellaneous personal services
73	BUSINESS SERVICES
7311	Advertising agencies
7312	Outdoor advertising services
7313	Radio, TV, publishers
7319	Advertising, nec.
7321	Consumer credt. reptg. agencies
7331	Direct mail advertising services
7332	Blueprinting and photocopying services
7333	Commercial photo, art, and graphics
7339	Steno and dup. services, nec.
7341	Window cleaning

SIC	DESCRIPTION
7342	Exterminating services
7349	Miscellaneous building services, nec.
7351	News syndicates
7361	Employment agencies
7362	Temporary help supply services
7369	Personnel supply services, nec.
7372	Computer prog. and software services
7374	Data processing services
7379	Computer related services, nec.
7391	Research and development labs.
7392	Management, consulting services
7393	Detective agencies
7394	Equipment rental services
7395	Photofinishing laboratories
7396	Trading stamp services
7397	Commercial testing laboratories
7399	Business services, nec.
75	**AUTOMOTIVE REPAIR**
7512	Car rental without drivers
7513	Truck rental without drivers
7519	Utility trailer and recreational venicle rental
7523	Parking lots
7525	Parking structures
7531	Top and body repair shops
7534	Tire retreading and repair shops
7535	Paint shops
7538	General automotive repair shops
7539	Automotive repair shops, nec.
7542	Car washes
7549	Auto services, except repair and car washes

SIC	DESCRIPTION
76	**MISCELLANEOUS**
7622	Radio and television repair shops
7623	Refrigerator and air conditioning services and repairs
7629	Electrical repair shops, nec.
7631	Watch, clock and jewelry repair
7641	Reupholstery and furniture repair
7692	Welding repair
7694	Armature rewinding shops
7699	Repair shops, nec.
89	**MISCELLANEOUS SERVICES**
8911	Engineering and architectural services
8922	Noncommercial educ. sci. and res.
8931	Accounting, audit and bookkeeping
8999	Services, nec.

APPENDIX B

DESCRIPTION OF DATA CODING SYSTEM FOR SURVEY QUESTIONNAIRE

NAME : _____

STREET : _____

CITY : _____ POSTAL CODE : _____

CONTACT : _____ TELEPHONE : _____

NATURE OF BUSINESS : (PRINCIPAL PRODUCTS AND/OR SERVICES

_____

DUN AND BRADSTREET NUMBER : _____

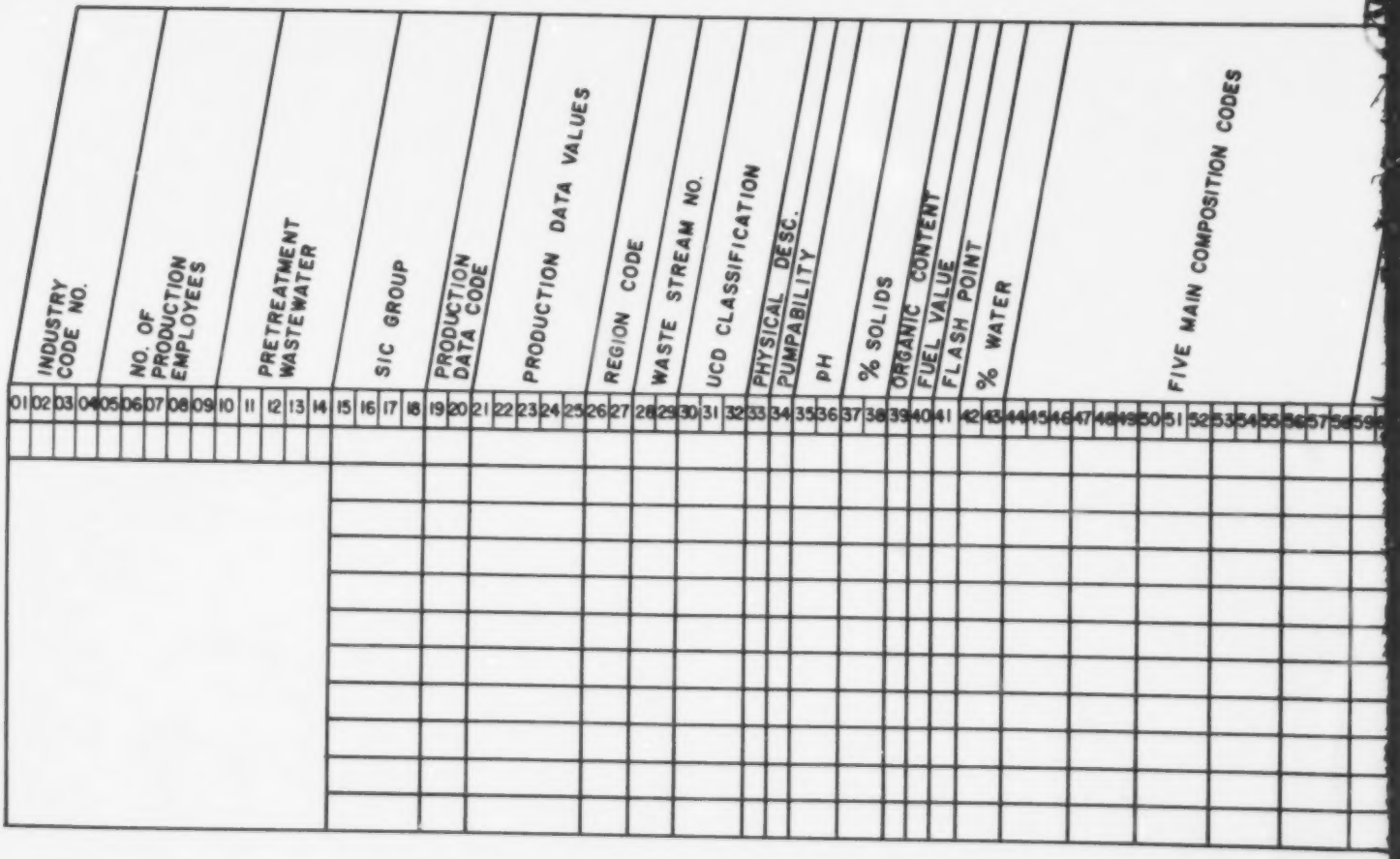
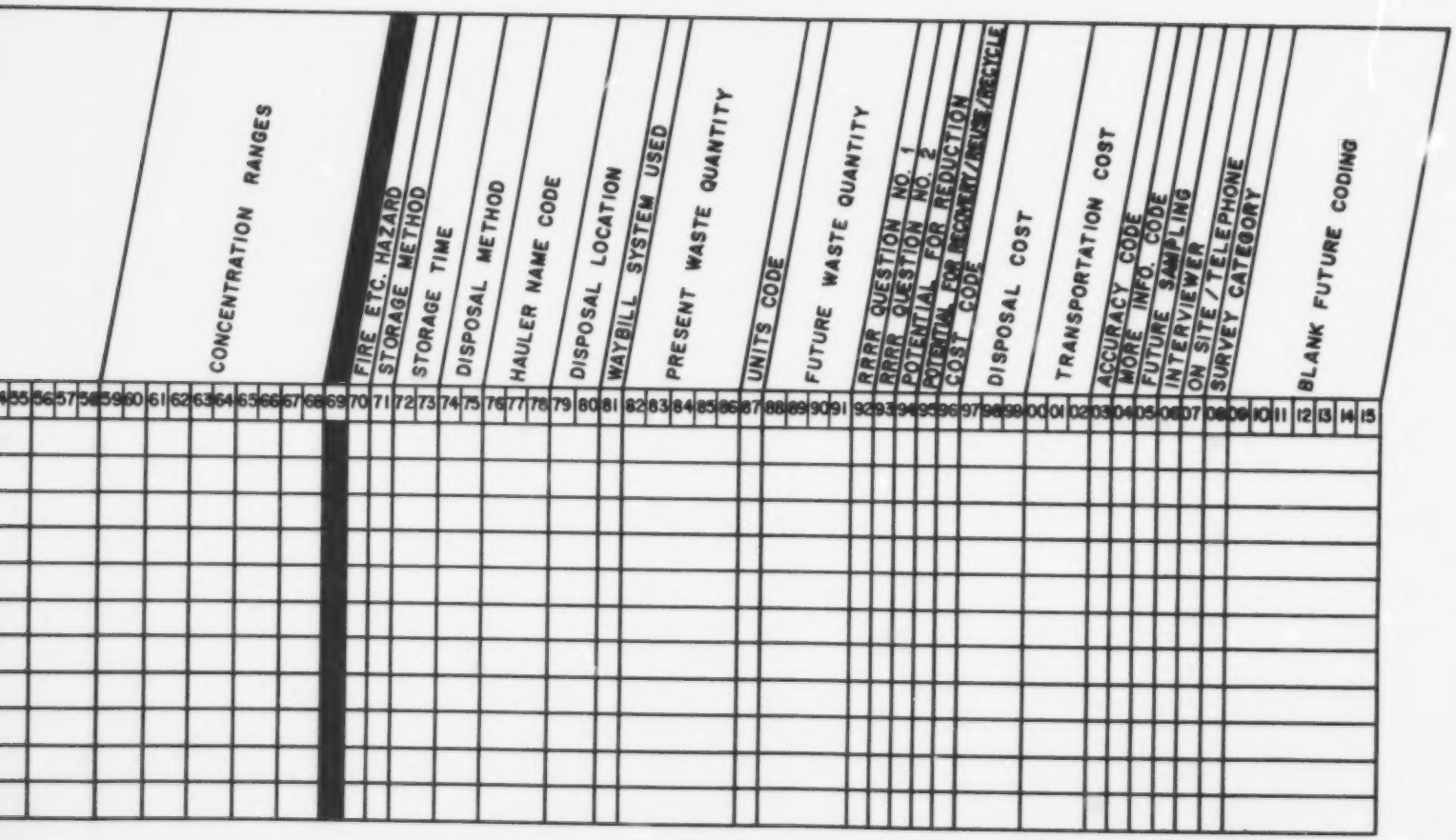

INDUSTRY CODE NO.
NO. OF PRODUCTION EMPLOYEES
PRETREATMENT WASTEWATER
SIC GROUP
PRODUCTION DATA CODE
PRODUCTION DATA VALUES
REGION CODE
WASTE STREAM NO.
UCD CLASSIFICATION
PHYSICAL DESC.
PUMPABILITY
PH
% SOLIDS
ORGANIC CONTENT
FUEL VALUE
FLASH POINT
% WATER
FIVE MAIN COMPOSITION CODES
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59

FIGURE 1 — CODING FORM

SERVICES) ____

OWMC DATA CODING SHEET

(REV. - 6 , MAY 1 , 1984)



FORM FOR SPECIAL WASTES

DESCRIPTION OF
DATA CODING SYSTEM FOR QUESTIONNAIRE

ENTRY COLUMN

01-04 INDUSTRY CODE #

- Sequential number from 0001-9999 corresponding to establishment name (to maintain confidentiality).

- Access to company name, address, contact, phone number corresponding to each code is through a confidential industrial code listing.

05-09 NUMBER OF PRODUCTION EMPLOYEES

- Up to a 5-digit number indicating the number of production employees at the plant site.

10-14 WASTEWATER PRETREATMENT

- Space is provided for five, 1-digit numbers denoting up to five types of treatment provided in-plant (excluding sanitary waste and storm water).

0 = no treatment/no process wastewater	5 = pits, ponds or lagoons
1 = pH adjustment	6 = filtration
2 = skimming and/or settling	7 = activated sludge
3 = coagulation and/or precipitation	8 = other
4 = dissolved air flotation	9 = no data available

15-18 SIC GROUP (see Appendix A)

- Entry of 4-digit primary Standard Industrial Code for establishment.

19-20 PRODUCTION DATA CODE

- Provision is made for a 2-digit number which delineates the type of production data available for establishment.

0 = No data	6 = millions of board ft/year
1 = Sales ($/yr)	7 = gallons/yr
2 = tons/yr	8 = millions of m^2/year
3 = units/yr	9 = million feet/year
4 = Sales ($ millions)	10 = million ft^3/year
5 = millions of units/year	11 = millions of tons/year
	12 = millions of Igal/yr

21-25 PRODUCTION DATA VALUE

- Provision for a 5-digit number denoting production value.

26-27 REGIONAL DATA CODE (see Table B-1)

- Provision is made for a 2-digit number which delineates the geographic region that the establishment is in. The Regions used are those developed by Proctor and Redfern (1982):

  01 = Aurora
  02 = Barrie
  03 = Belleville
  etc.

28-29 WASTE STREAM #

- 2-digit number denoting individual wastes within the same establishment (ie. an establishmen may have several wastes, each of which is described separately). Actual number will relate to process flow diagram, if provided.

  Blank = no waste
  01 = first waste characterized
  02 = second waste characterized
  ..
  ..
  99 = up to 99 wastes can be coded for an industry

30-32 UCD CLASSIFICATION* (see Table 10)

- Space is provided for a 3-digit number denoting the waste type according to the UCD classification system.

33 OVERALL PHYSICAL DESCRIPTION OF WASTE AT 21°C*

- Space is provided for a 1-digit number code corresponding to the overall physical characteristics of the waste where:

1 = solid	4 = oil-water emulsion
2 = liquid	5 = slurry
3 = sludge/paste	6 = separates into layers on standing

34 PUMPABILITY*

Space is provided for a 1-digit number code corresponding to the pumpability of waste where:

1 = pumpable at 21°C	3 = Not pumpable
2 = pumpable at elevated temperature (38°C) only	4 = Not applicable (ie. solid)

35-36 pH*

- Space is provided for a 2-digit number to report the approximate average pH of the waste (ie. 01-14) if available. This only applies to liquids and wastewater sludges.
  If no data, leave blank.

* Refer to Interviewer Guidelines following the Questionnaire

37-38 PERCENT TOTAL SOLIDS*

- Space is provided for a 2-digit number to report the approximate average percent solids concentration of sludges, if available (ie. 01-99). If no data, leave blank.

39 ORGANIC/INORGANIC CONTENT*

Space is provided for a 1-digit number to report the approximate organic content of the wastes where

1 = greater than 75%
2 = 25-75%
3 = less than 25%
4 = unknown

40 FUEL VALUE*

- Space is provided for a 1-digit number to denote the relative BTU value of the waste where:

1 = rich (over 12,000 BTU/lb)
2 = intermediate (5000-12,000 BTU/lb)
3 = lean (5000 BTU/lb)
4 = unknown
5 = not applicable (ie. inorganics)

41 FLASH POINT*

- Provision for a 1-digit number to denote the relative flash point of the waste (primarily for solvents and solvent water mixtures) where

1 = above 50°C
2 = below 50°C
3 = unknown
4 = not applicable (ie. solids)

42-43 % WATER*

- Provision for a 2-digit number indicating the percent of water in the waste (primarily for solvents and oily wastes) ie. 0-99%. If unknown or not applicable, leave blank.

44-58 COMPOSITION* (see Table B-3)

- Space is provided for 5, 3-digit numbers to report composition up to five main constituents of the waste. Table B-3 summarizes the code keys.

59-68 TYPICAL CONCENTRATION*

- Space is provided for 5, 2-digit numbers reporting the concentration in % of the five main constituents identified before, where:

0 = less than 1% (in ppm range)
1 = 1%
2 = 2%
99 = 99%

* Refer to Interviewer Guidelines following the Questionnaire

70 FIRE/EXPLOSION HAZARD*

- Provision for a 1-digit number indicating fire/explosion hazard where:

1 = Explosive or Flammable
2 = Reacts with Air
3 = Reacts with Water
4 = No Hazard
5 = Other

71 STORAGE METHOD

- Space is provided for a 1-digit number to denote the storage method used for the waste.

1 = pits, lagoons, etc.
2 = drums
3 = tank
4 = 5 gallon pails or jugs
5 = wooden boxes
6 = piles
7 = disposal bin
8 = within the process
9 = not stored

72-73 STORAGE TIME

- Space is provided for a 2-digit number to report the storage time where:

1 = 1-3 months
2 = 3-6 months
3 = 6 12 months
4 = 1-2 years
5 = 2 years
6 = unknown
7 = not stored
8 = less than one month
9 = indefinite

74-75 DISPOSAL METHOD

- Space is provided for a 2-digit number denoting the present waste disposal method principally used for the waste where:

Treatment/Disposal On Site

01 Biological
02 Physical-Chemical
03 Incineration
04 Volume Reduction
05 Landfill
06 Land Farming
07 Recycle/Reuse/Recovery*
08 Long Term Storage
09 Solidification
17 Other
18 Septic Tank

Release to Sewer

10 Periodic
11 Continuous
12 Pretreat and Release

Direct Disposal

13 Sold
14 Waste Exchange
15 Hauled Away from Site for Disposal
16 Hauled Away from Site for Recycle*
19 Unknown
20 Municipal Garbage

* Refer to Interviewer Guidelines following the Questionnaire

76-78 HAULER NAME CODE

- Space is provided for a 3-digit number denoting the hauler for the waste. A master confidential code of haulers is maintained.

  998 = unknown hauler

79-80 DISPOSAL LOCATION* (see Table B-4)

- Provision for a 2-digit number denoting the ultimate disposal location presently used for the waste.

81 WAYBILL SYSTEM*

- Provision for a 1-digit number denoting the wastes status vis-a-vis the MOE waybill system where:

  1 = Waybill system used
  2 = Waybill system not used
  3 = unknown

82-86 PRESENT WASTE QUANTITY

- A 5-digit number denoting the present waste quantity generation per year. If unknown leave blank. If very small amount = 00.

87 UNITS CODE

- Space for 1-digit unit code. The unit code is:

0 = no data	3 = yds^3/year	6 = Myal/yr
1 = tons/year	4 = tonnes per year	7 = ft^3/yr
2 = Imperial gallons/yr	5 = units/year (ie. drums, pallets, etc)	8 = lbs/yr
		9 = tons/yr x 1000

88-91 FUTURE WASTE QUANTITY

- Space is provided for a decimal fraction number (ie. 0.1-9.9) denoting the fraction of the present waste quantity anticipated in the near future (ie. up to 5 years). For example, 2.0 would indicate waste quantity to double.

* Refer to Interviewer Guidelines following the Questionnaire

92 RRRR Question #1

- 1-digit number indicating response to the following question. "If future quantities of waste are different from the present quantities, what is the reason?" Possible responses:

0 = other (state)
1 = plant expansion
2 = shut down of certain operations
3 = volume reduction
4 = greater degree of reuse, recovery or recycle
5 = treatment on site in future
6 = increased production
7 = lower degree of RRRR
8 = improved plant operations
9 = not applicable

93 RRRR Question #2

- 1-digit number indicating response to this question. "Will the establishment consider implementation of a RRRR option in the future?". Where:

1 = yes
2 = no, adverse effects on product
3 = no, (too costly)
4 = no, no use
5 = haven't considered
6 = already implemented
7 = other (state)
8 = no, safety
9 = not applicable

94 POTENTIAL FOR REDUCTION*

- 1-digit number indicating the potential for further waste reduction, where:

0 = none
1 = some
2 = high
3 = not applicable (already implemented)

95 POTENTIAL FOR RECOVERY/REUSE/RECYCLE

- 1-digit number indicating the potential for further recovery/reuse/recycle (RRR), where:

0 = none
1 = some
2 = high
3 = not applicable

96 COST CODE

- 1-digit number denoting whether costs are separated into disposal and transportation costs.

0 = yes
1 = no (total cost listed as disposal cost)
2 = unknown cost
3 = not applicable

* Refer to Interviewer Guidelines following the Questionnaire

97-99 DISPOSAL COST

- 3-digit number indicating the present cost of disposal in $/Igal or $/ton. Units code in column 87 will also indicate the units for disposal cost. This cost will be the actual disposal cost once the waste reaches the disposal site; eg. $10/ton or 50¢/Igal, or if so indicated in column 96, will be total cost (disposal and transportation).

100-102 TRANSPORTATION COST

- 3-digit number indicating the present cost of transporting the waste from the point of generation to the disposal site. Does not include disposal cost. Units are the same as disposal cost units.

103 ACCURACY CODE*

- Space is provided for a 1-digit number summarizing the interviewer's impression of the completeness and accuracy of the information obtained.

  1 = excellent
  2 = good
  3 = fair (adequate)

104 MORE INFORMATION CODE

- Where applicable, separate data files will be created for each industry. Provision is made for a 1-digit number which will denote whether such data other than contaminants is on file (eg. process flow diagrams). Where:

  0 = no supplemental data on file
  1 = supplemental data on file

105 FUTURE SAMPLING

- 1-digit number denoting response to the question, would it be possible to obtain samples of the waste(s) denoted herein for further analysis? Where:

  0 = No
  1 = Yes
  2 = Not applicable (ie. no wastes)

106 BLANK

107-108 INTERVIEWER CODE

- 2-digit number indicating the initials of the person who carried out the telephone or on-site interview.

* Refer to Interviewer Guidelines following the Questionnaire

109 BLANK

110-111 TYPE OF INTERVIEW

- 1-digit number indicating the type of interview conducted, where:

  1 = telephone
  2 = on-site

112 BLANK

113-114 SURVEY CATEGORY

  First 500 Survey = 1
  Second 500 Survey = 2

TABLE B-1

REGIONAL CODES

	REGIONAL AREA
001	AURORA
002	BARRIE
003	BELLEVILLE
004	BRAMPTON
005	BRANTFORD
006	BROCKVILLE
007	CHATHAM
008	COBOURG
009	COCHRANE
010	CORNWALL
011	DUNVILLE
012	GRIMSBY
013	GUELPH
014	HALTON HILLS
015	HAMILTON
016	HAWKESBURY
017	HUNTSVILLE
018	KIRKLAND LAKE
019	KINGSTON
020	KITCHENER
021	LINDSAY
022	LONDON
023	NORTH BAY
024	MISSISSAUGA
025	OAKVILLE
026	ORANGEVILLE
027	OSHAWA
028	OTTAWA
029	OWEN SOUND
030	PETERBOROUGH
031	SARNIA
032	SAULT STE. MARIE
033	SIMCOE
034	ST. CATHARINES
035	ST. THOMAS
036	STRATFORD
037	SUDBURY
038	THUNDER BAY
039	TORONTO
040	WALKERTON
041	WELLAND
042	WINDSOR
043	WOODSTOCK
044	OTHER NE 7 CENTRAL
045	OTHER NW
046	OTHER S CENTRAL
047	OTHER SOUTH EAST
048	OTHER SOUTH WEST

TABLE B-2

MASTER LIST OF SELECTED WASTE CONSTITUENTS

Contaminant :	Numeric Code #
Acetone	1
Acrylonitrile	2
Alcohol	3
Aluminum	4
Amines	5
Anhydrides	6
Antimony	7
Arsenic	8
Asbestos	9
Azo & Diazo Dyes	10
Bentonite/Clay	11
Benzothiazoles	12
Beryllium	13
Boron	14
Cadmium	15
Carbon Tetrachloride	16
Caustic	17
Cellulose	18
Chlorinated Benzenes	19
Chlorinated Ethylenes	20
Chloroform	21
Chlorophenols	22
Chromium	23
Cobalt	24
Copper	25
Cresols	26
Cyanates	27
Cyanide	28
Ammonium Phosphate	29
Ether	30
Ethylbenzene	31
Ethylene Glycol	32
Formaldehyde	33
Freon	34
Furfural	35
Iron	36
Latex	37
Lead	38
Magnesium Oxide	39
Mercaptans	40
Mercury	41
Methylene Chloride	42
Methyl Ethyl Ketone	43
Methyl Isobutyl Ketone	44
Mineral Acids	45
Mineral Spirits	46
Naphthalene	47
Nickel	48
Nitrosamines	49
Nylon	50
Oil & Grease	51
Organic Acids	52
Organic Halides	53

TABLE B-2

MASTER LIST OF SELECTED WASTE CONSTITUENTS
(continued)

Paint or Ink Pigments	54
Perchloroethylene	55
Pest/Herbicides	56
PCB'S	57
Phenols	58
Phosphate	59
Picric Acid	60
Plasticizers	61
Polyamides	62
Polyurethane	63
Quinoline	64
Radioactive Isotopes	65
Resins	66
Rubber	67
Selenium	68
Silica	69
Silver	70
Sodium Bisulfate	71
Starch	72
Styrene	73
Sulphur	74
Thallium	75
Tin	76
Toluene	77
Vanadium	78
Varsol	79
Polyvinyl Chloride	80
Xylene	81
Yeast	82
Zinc	83
Carbon	84
Aromatic Hydrocarbons	85
Aliphatic Hydrocarbons	86
Titanium	87
Esters	88
Biological Matter	89
Adipic Acid	90
Cresylic Acid	91
Naphthas	92
Magnesite	93
Aluminum Oxide	94
Sodium Monoxide	95
Calcium Oxide	96
Ferric Oxide	97
Xylol	98
Calcium Carbonate	99
Chlorinated Hydrocarbons	100
Calcium Hydroxide	101
Lacquer	102
Polyethylene Waxes	103
Polyethylene	104
Peroxide	105
Pyridine	106

TABLE B-2

MASTER LIST OF SELECTED WASTE CONSTITUENTS
(continued)

Hexanes	107
Trinonylphenol Phosphite	108
Ferro-alloy	109
Chromium Alkyl Aluminum	110
Triethylaluminum	111
Titanium Tetrachloride	112
Magnesium Chloride	113
Ketones	114
Neoprene	115
Leather dust	116
Detergent	117
Petroleum Waxes	118
Tar/Asphalt	119
Sulphuric Acid	120
Oxalic Acid	121
Potassium Chlorite	122
Sodium	123
Organic Solvents	124
Inorganic Salts	125
1,1,1 Trichloroethane	126
Kerosene	127
Cotton	128
Organic Dyes	129
Diatomaceous Earth	130
Gold	132
Nitrite/Nitrate	133
Solder Flux	134
Polyester	135
Phosphorous Compounds	136
Hydrazine	137
Sodium Sulphate	138
Sodium Phosphate	139
Sodium Nitrate	140
Organic Polymers	141
Solvents (nec.)	143
Trichlorofluorocarbon	145
Glycol Ether Solvent	146
Surfactants	147
Tetraethyl-lead	148
Sodium Fluoride	150
Ammonium Bifluoride	151
Ammonium Dimolybdate	152
Metals	153
Nickel Hydroxide	154
Nickel Chloride	155
Steel	156
Chromic Acid	157
Isocyanate	158
Lead Oxide	159

TABLE B-2

MASTER LIST OF SELECTED WASTE CONSTITUENTS
(continued)

Heavy Metal Hydroxides	160
Sugars	161
Fluorinated Compounds	162
Urethane	164
Lye	165
Glycerine	166
Tallow	167
Acetates	168
Sodium Carbonate	169
Sulphonates	170
Potassium	171
Emulsifiers	172
Brass	173
Silver Bromide	174
Sodium Tetraborate	175
Calcium Sulphate	176
Sulphonic Acid	177
Styrene Butadiene	178
Magnesium Silicate	179
Calcium Stearate	180
Aluminum Stearate	181
Vegetable Oil	182
Sulphurized Fats	183
Ammonium Hydroxide	184
Ammonium Persulphate	185
Metallic Sulfate	186
Brominated Compounds	187
Ammonium Nitrate	188
Ammonium Chloride	189
Hydrogen Peroxide	190
Photochemicals	191
Sodium Aluminate	192
Organic Chemicals	193
Polypropylene	194
Anti-foaming Agent	195
Pentaerythritol	196
Photographic Fixing	197
Developer Solution	198
Pharmaceutical Waste	199
Chromates	200
Adhesives	202
Grit	203
Varnish	204
Glass	205
Metallic Oxides	206
Zinc Oxide	207
Iron Phosphate	208
Iron Oxide	209
Rust Inhibitors	210
Metal Chips/Dust	211

TABLE B-2

MASTER LIST OF SELECTED WASTE CONSTITUENTS
(continued)

Paper	214
Shellac	215
Benzene	216
Isopropyl Alcohol	217
Plastics	218
Bronze	219
Silicones	220
Mineral Oil	221
Chlorinated Paraffins	222
Iron Salts	223
Acids	224
Silver Compounds	225
Calcium Hypochlorite	226
Zirconium	227
Chromium Salts	228
Soaps	229
Sulphides	230
Potassium Nitrate	231
Aldehydes	232
Palladium	233
Nitric Acid	234
Bromide	235
Hydrocarbon (Unsat.)	236
Magnesium	237
Titanium Dioxide	238
Tin Compounds	239
Coal	241
Chlorides	242
Sodium Dodecylbenzene	244
Petroleum Ether	245
Ethyl Ether	246
Hexahydric Alcohol	247
Sodium Cyclamate	248
Ferrous Sulphate	249
Sodium Chloride	250
Zinc Sulphate	251
Glycols	252
Ethylene Oxide	253
Calcium Chloride	254
Bacteriacide/Germicide	256
Fluoride	258
Sulphate	259
Urea	260
Coke	261
Carborundum	262
Ash	263
Aluminum Chloride	264
Talc	265

TABLE B-2

MASTER LIST OF SELECTED WASTE CONSTITUENTS
(continued)

Molybdenum	266
Sodium Stearate	267
Potassium Chloride	268
Xanthate	269
Fatty Acid	270
Lead Chloride	271
Lead Hydroxide	272
Leather (Offspec.)	273
Fungicide	274
Hydrochloric Acid	275
Acrylic Resins	276
Sodium Oleate	277
Metal Sulphides	278
Butadiene	279
Magnesium Hydroxide	280
Sodium Salts	281

INTERVIEWER GUIDELINES

1.0 DETERMINATION OF WHETHER THE WASTE IS A PROCESS WASTEWATER OR A SPECIAL WASTE

In some cases, the interviewer will be required to make a decision on whether a waste(s) being generated by an establishment is a process wastewater or a special waste that should be coded as part of the survey. The following guidelines should be applied:

1) The waste should be considered to be a process wastewater (not coded) if:
   a) it meets (based on evidence provided by the interviewee or based on the interviewer's knowledge or experience) the relevant sewer use by-law for the municipality in which the establishment is located; or
   b) it is generated on a continuous basis and is sufficiently dilute or contains contaminants which will not have a detrimental effect on the sewerage system or the municipal water pollution control plant; or
   c) it is discharged on a continuous basis to an on-site industrial pretreatment facility.

   Examples of process wastewaters would include dilute rinsewaters generated by metal plating operations, oily wastewaters continously discharged to an oil separation unit or suspended solids-bearing streams continuously discharged to a clarification process.

2) The waste should be considered to be a special waste and coded as part of the survey if:
   a) it fits into a UCD category, and
   b) it does not meet the by-law requirements, or
   c) it is being intentionally diluted or bled into the sewer system so as to meet the by-law.

   Examples of wastes which should be considered to be special wastes would include concentrated acid or alkali wastes discharged on a batch or semi-batch basis to the sewer or concentrated plating solutions.

2.0 UCD CLASSIFICATION

In some cases, a waste may be placed in one or more UCD categories (Table 10) depending on its source and known or probable contaminants [for example, in the oily wastes category (UCDs 281 through 289), a waste may fit in one or more categories). These situations are to be discussed with the interview team and a consensus reached on the best UCD allocation for the waste which is consistent with allocations made for similar survey wastes. Wastes containing both organic and inorganic contaminants should be placed in the appropriate organic or inorganic UCD category based on the contaminants present in the highest concentrations.

3.0 OVERALL PHYSICAL DESCRIPTION OF WASTE

Assignment to one of the possible categories is to be made based on factors such as the interviewee's description of the waste solids level (if available) and interviewer's knowledge or prior experience with similar wastes.

4.0 PUMPABILITY

Assignment to one of the possible categories is to be made primarily on interviewee's knowledge and experience of the waste handling characteristics and the present handling method at the source. If necessary, solids information can be utilized to assist categorization.

5.0 pH

If actual pH data are available, these should be used. If no data are available, use interviewee's qualitative description (acid, neutral, alkaline, etc.) and prior experience or knowledge with similar wastes to assign a value. If no data at all, leave blank.

6.0 PERCENT TOTAL SOLIDS

If actual data are available, these should be used. Otherwise, use combination of interviewee qualitative information and prior experience to assign a value. If no data at all, leave blank.

7.0 ORGANIC/INORGANIC CONTENT

Use interviewee's quantitative or qualitative data and contaminant information to assign to one of the indicated categories. The water content of the waste is considered in the classification (ie. a waste that is 10% organic matter and 90% water is classified as less than 25% organic). If there is a scarcity of data or knowledge regarding waste make-up, leave blank. All inorganic wastes should be indicated as less than 25%.

8.0 FUEL VALUE

Use interviewee's data and contaminant information to assign to one of the indicated categories. The fuel value of the total waste (including water) is categorized, not the fuel value of the organic contaminants. Wastes with a relatively high water content and organic contaminants should be listed as "lean". Inorganic wastes should be assigned to the "not applicable" category.

9.0 FLASH POINT

Use actual flash point data, if available. Alternatively, use actual contaminant data, and if necessary, interviewee knowledge and experience to determine what volatile materials are present in the waste. Use flash point of most volatile compound as the flash point of the waste. Indicate as unknown if no data or not applicable for solid material.

10.0 % WATER

If interviewee has data or knowledge of the water content of the waste, indicate, otherwise, leave blank.

11.0 COMPOSITION

If the interviewee has analytical data or knowledge of the waste contaminants, list with appropriate concentrations. If interviewer has knowledge or experience with similar wastes, list most probable contaminants.

12.0 FIRE/EXPLOSION HAZARD

Use interviewee's knowledge, analytical data and flash point information, if available, to assign to one of the indicated categories. If other hazards are identified by the interviewee, these should be stated. These "other hazards" may relate to toxicity or occupational hazards associated with handling of the waste.

13.0 DISPOSAL METHODS

13.1 ON-SITE RECYCLE/REUSE/RECOVERY

Some establishments may not consider a waste stream which is recycled/reused or otherwise recovered for return to the process or marketing as a by-product to be "a waste" and will be reluctant to provide the interviewer with data on these materials. Wherever possible, the interviewer should determine if the establishment is applying recycle/reuse/recovery techniques to handle a waste stream and acquire as much information as possible on that waste stream and code it as a special waste.

13.2 HAULED AWAY FROM SITE FOR RECYCLE/SOLD

If the waste material is hauled off-site and goes to a reclamation or recovery facility (solvent, oil or others), the direct disposal option of "hauled away from site for recycle" should be indicated regardless of whether the reclaimed material is returned to the site or not, or whether the establishment is paid for, or pays the hauler, for waste handling. If the reclaimer pays the generator for the waste, the direct disposal option of "sold" should be indicated. If the generator is given a credit against new material by the reclaimer, the direct disposal option of "hauled away from site for recycle" should be indicated.

14.0 DISPOSAL LOCATION

If possible, the ultimate disposal location of the waste should be determined from the interviewee. However, in some cases, the intermediate disposal location (ie. a transfer station) may only be known. If this is the case, indicate this as the disposal location. If interviewee does not know disposal location, indicate as unknown. If waste is hauled to a reclamation facility, this should be indicated as the disposal location.

15.0 WAYBILL SYSTEM

The determination of whether or not the MOE Waybill System is used for the waste disposal is based strictly on the interviewee's knowledge.

16.0 POTENTIAL FOR REDUCTION

The "potential for reduction" is based on a judgement (based on interviewer's prior experience with similar type wastes) of the potential for reducing the particular wastes volume by the application of existing technology (eg. dewatering, concentration, etc.). If volume reduction is already being used, this should be indicated.

17.0 POTENTIAL FOR RECOVERY/REUSE/RECYCLE

The potential for recovery/reuse/recycle is based on a qualitative judgement (based on interviewer's prior experience with similar waste types) of the potential for recovering/reusing or recycling the particular waste within the existing or a modified production processes. If already being practiced, this should be indicated.

APPENDIX C

LETTER OF INTRODUCTION SENT TO SAMPLE GROUP ESTABLISHMENTS BY OMMC

OWMC

**Ontario
Waste Management
Corporation**

2 Bloor Street West
11th Floor
Toronto Canada
M4W 3E2
(416) 923 2918

June 4, 1984

Dear

As you may know, the Ontario Waste Management Corporation (OWMC) is a provincial crown agency, established in 1981 to design and implement a liquid industrial waste treatment and disposal system for Ontario. At the present time, we are searching for suitable locations within the Golden Horseshoe for these facilities. This process will conclude with detailed proposals on the location, size and type of treatment and disposal technologies to be used, which will be the subject of public hearings conducted by a government-appointed Hearing Panel.

To ensure that these facilities are safely located and properly sized, we have been collecting data on a wide range of environmental, engineering and planning issues. It is in this regard that I am writing to request your assistance.

One of the most important planning efforts we must undertake prior to the completion of our proposal is a marketing analysis, to ensure that the types and volume of liquid industrial and hazardous waste likely to require treatment and disposal at OWMC's facilities have been accurately identified. As the first step in this analysis, last year we conducted an initial waste inventory survey, which provided us with general estimates on overall waste quantities produced throughout all of Ontario. We must now refine this data base, with particular emphasis on identifying more specifically the quantities and types of waste OWMC may

expect to receive. This information is essential to the decisions we must make on the size of our facilities in particular.

We have retained CANVIRO Consultants Ltd. of Kitchener, Ontario (further background information on CANVIRO is attached) to assist us in collecting and analyzing more detailed information on waste quantities and types through direct contact with a representative cross-section of Ontario industries. It is planned to interview over 1,000 randomly selected industries; to date 500 interviews have been completed. Within the next few weeks a representative from CANVIRO will be calling you to determine an appropriate contact person within your company and to discuss your on-going involvement in this project. The interview personnel will be seeking information from the selected companies on:

- basic company statistics;
- quantity and characteristics of liquid or special wastes;
- storage and disposal methods;
- disposal locations and costs.

A copy of the project questionnaire is attached.

The information gathered will be analyzed to determine more specific details on the types of waste treatment processes needed by Ontario industry and the kinds of size and design criteria that need to be incorporated into the development of OWMC's facilities.

Thank you for your attention to this matter. We would very much appreciate your assistance in our development of appropriate industrial waste treatment facilities for Ontario.

Sincerely,

D.A. Chant
Chairman and President

Attachments

CANVIRO CONSULTANTS LTD.

178 LOUISA ST., KITCHENER, ONTARIO N2H 5M5 519-579-3500

CANVIRO is an environmental engineering firm specializing in the development and application of water, wastewater, sludge and industrial liquid and special waste management technology. The company has office and laboratory facilities based in Kitchener, Ontario and since 1976 has developed around a nucleus of senior personnel experienced in all aspects of environmental engineering. CANVIRO's staff of thirty people is comprised of professional engineers (chemical and environmental), designated consulting engineers, chemists, certified engineering technologists, computer specialists and support personnel.

CANVIRO has broad-based experience in the field of industrial processes and wastewater treatment and disposal. This industrial experience covers virtually every SIC sector, some examples being:

- Treatability and process design projects for meat packing, snack food, fish processing, vegetable processing and dairy product clients.
- Pilot plant studies on steel industry wastewaters.
- Design of treatment system improvements for several metal finishing operations.
- Pre-treatment investigation for a tire manufacturer.
- Characterization, treatability and design services for a specialty chemical manufacturer.
- Water conservation and residue reduction projects for a large automobile manufacturer.

CANVIRO has recently completed an inventory of the liquid and special industrial wastes for the Region of Waterloo. In addition, the principals of CANVIRO have a minority interest in a company which provides on-site treatment services to the industrial sector. The techniques and experiences gained as a result of these and other projects will definitely be an asset to the OWMC study of waste management methods and characterization.

APPENDIX D

DESCRIPTION OF COMPUTER PROGRAM UTILIZED FOR SURVEY DATA ANALYSIS

1.0 INTRODUCTION

In order to facilitate the data handling and analyses for the 1000 establishments included in the survey a special data base management program was created. Through the use of this program and related programs all data logging, editing and analyses were carried out.

The major objectives of the program were:

1) To be easy to use so that nontechnical staff could carry out most functions.
2) To provide a means by which records of every establishment surveyed could be quickly viewed or edited.
3) To be readily expandable to allow for an increased data base size.
4) To provide a means to carry out a selective search or sort based on user created keys as derived from the waste record classifications. (Appendix B).

The program "OWMCSURV" was written using the BASIC programming language on the IBM Personal Computer. To enhance performance, the program was compiled. The program assumes the use of a hard disk for data storage.

2.0 PROGRAM FILES

The program "OWMCSURV", when executing, will use two other program files and access four data files. Due to memory considerations, OWMCSURV exists in three parts. The main part is OWMCSURV and the other two are "RANDB2" and "PHASE3RP". The switching back and forth between the programs is automatic.

The data files accessed are:

1) "KEY.DAT" - Upon "OWMCSURV" start-up, this file will be read to obtain the actual meanings of the numeric codes in each waste record classification. Hauler name code translations have been purposely left out to maintain confidentiality.

2) "ESTSURV1.DAT" - This file contains the relevant waste information for all establishments. The file is divided into records whereby each waste stream is classified as a record. The coding format corresponds to the format on the coding form discussed in Appendix B.

3) "RANDOM.SIC" & 4) "RANDOM2.SIC" - These files contain the basic statistics on each establishment such as contact person, company address and lune of business. These files are not necessary to perform searches on the data base.

3.0 PROGRAM USAGE

The program is menu driven (ie. by reading and entering choices the user can progress through the various routines) and is divided into three sections, as shown below:

```
                    MAIN MENU


          1) Perform Data Editing or Input.
          2) View Records.
          3) Perform Searches on data Files.
          4) End the program.

     Choice? (1,2,3 or 4)
```

4.0 DATA INPUT AND EDIT

Upon choosing the data input and edit option, the user has a number of choices (shown below). Choice one is a routine to allow updates to the establishments' basic statistics as originally provided by Dun & Bradstreet. This routine currently allows for a maximum of 1026 establishments, but can be expanded. Choice two allows the user to input more waste records. A maximum of 3000 records are currently allowed for, but this number can be increased. The third choice allows the user to edit the waste records which had been previously entered.

```
                    EDIT MENU


     Please indicate your choice for editing records or inputing new records.

          1) Edit the file containing the industries basic statistics.
          2) Input new waste records.
          3) Edit the waste records.
          4) Return to main menu.

     Choice ? (1,2,3 or 4)
```

5.0 VIEW DATA

The second major section (shown below) of the program allows the user to view the basic statistics or waste record data on the screen or printer. The basic statistics file viewing option allows the user to choose the establishment he wishes to view by random record number. A sample printout appears in Table D-1.

```
                    VIEW MENU

Please indicate your choice for viewing records.

        1) View basic statistics file.
        2) View waste quantity and characteristics file.
        3) View waste quantity and phase 3 estimation data.
        4) Return to main menu.

Choice ? (1,2,3 or 4)
```

The waste quantity and characteristics viewing option allows the user to view the records in one of two formats. Records chosen by record number can be viewed in a "condensed" output available on the screen or printer, a sample of which appears in Table D-2. The categories shown are left in the numeric key code and hence have to be interpreted by the user.

A second output format for the waste records can be achieved as an option to the printer only. This requires the use of 15" wide forms paper. It is an expanded format whereby all major categories and their translated responses are shown. An example is shown in Table D-3. These same two printing options can also be applied to the waste records when searching through the data base.

The waste quantity and Phase 3 estimation option pertains to a related Waste Quantity and Characterization Study carried out for OWMC. This allows estimation data to be printed with each waste record.

6.0 SEARCHES

The third major section of the program allows the user to perform searches on the waste record data file. The search menu is shown below. Performing a

TABLE D-1

SAMPLE PRINTOUT OF BASIC STATISTICS FILE RECORD

Principal Off. : JOHN SMITH Random Record : 15
Telephone : (555)222-3333
Business Name : MNO PAINT CO. LTD
Street Address : 1 NORTH ROAD
City : ANYWHERE
Province : ON
Postal Code : A1A 1A1
Mailing Address : None
Line of business: PAINT
Employees Here : 250
SIC Number : 2066

TABLE D-2

CONDENSED PRINTOUT OF WASTE RECORDS

SURVEY 1 AND 2 01-23-1985

I.C.	# EMP	SIC	UCD	REGION	WS	MAIN COMPONENTS	QUANTITY	UNITS	INTERVIEWER
1	60	1611	281	20	1	51 36	3000	2	R.S.
2	6	1611	281	18	1	51 36	2000	2	R.S.
3	400	1611	281	4	1	36 51	3000	2	J.R.
4	10	3432	531	39	1	51 128	5000	5	J.R.
5	4	2951		42					E.S.
6	45	2044		42					J.R.
7	160	2016		4					S.N.
8	50	2022	281	20	1	51	50	2	R.R.
8	50	2022	145	20	2	250	4000	2	R.R.
9	59	2079	289	39	1	182	3000	2	M.J.

TABLE D-3

EXPANDED FORMAT WASTE RECORD

SURVEY.DAT 03-09-1984

IND.CODE	# EMP	PRODUCTION VALUE	SIC	REGION	D.PRE	ACCURACY	MORE INFORMATION	FUTURE SAMPLING	INTERVIEWER	TYPE
849	450	1000	Sales(Roll.)	2069 Brockville	54321	Excellent	Additional Data	Yes	R.S.	Onsite

WASTE STREAM : 2	MAIN COMPONENTS	CONC. I	CONSTITUENTS OF CONCERN	PRESENT QUANTITY	FUTURE
UCD : 444	Carbon Adipic Acid Cyanide Organic Acids		Data on File	34392 lgal/yr	1

PHYSICAL DESCRIPTION	PUMPABILITY	pH	%SOLIDS	%WATER	ORGANIC CONTENT	FUEL VALUE	FLASH POINT	HAZARD
Sludge/Paste	Pumpable at 21C	8	45	50	25-75%	(5000 BTU/lb	) 50 C	No Hazard

STORAGE METHOD	STORAGE TIME	DISPOSAL METHOD	HAULER CODE	DISPOSAL LOCATION	MANIFEST USED	DISPOSAL COST	TRANSFORMATION COST (# per present quantity units)
Pits,lagoons,etc	6-12 months	Hauled Away From Site	342	Tricil,Quebec	YES	.64	

REASON FOR INCREASE/DECREASE	CONSIDER ADD	REDUCTION POTENTIAL	POTENTIAL FOR ADDD
Not Applicable	No,Cost	None	None

search on the data implies that each record is examined to see if a specified condition or key is met. If the condition holds true the record is displayed and the appropriate information is retained. In order to use this option, the user must first choose the categories or keys that he wishes to find and then performs the search with the appropriate output being transmitted to the screen or printer.

SEARCH MENU

A search can be based on many or few factors. If you simply want to view all the records please use View Data option. You may search on as many keys or as few as you wish. To select more then one search key keep choosing option 2) .

Please indicate your choice for setting up searches.

1) Clear the current key(s).
2) Choose a new key to search on.
3) Perform a search on the files.
4) View the current keys.
5) View all possible keys.
6) Return to main menu.

Choice ? (1,2,3,4,5 or 6)

Under the search menu there are six options:

1) Clears the current user specified keys.
2) Allows the user to specify new or more keys.
3) Initiates the search performed by the computer.
4) Displays the current user specified keys on the terminal screen.
5) Displays the 51 major key categories and their corresponding numeric codes.
6) Returns the user back to the main menu.

With the exception of choosing new keys, the options are obvious and are initiated with the correct numeric response. The careful choosing of search keys and their conditions can allow the user to perform a multitude of searches. Currently the program allows for searches based on up to 40 keys which can be defined using OR or AND conditions. Two separate conditions joined by an OR clause will cause records which meet either of the two conditions to be displayed. Conditions which are separated by an AND clause will

cause only records which meet both conditions to be displayed. The AND condition is the normal separator between keys. If the user wants the OR clause to be inserted between two conditions, he responds with a YES to the question "Is there an OR condition?" when entering the two conditions.

For example, suppose the user wishes to view all records with a UCD Classification of 113. He must first know the numeric code for the UCD category. Using choice five, he can determine that the code is 9. Next he must specify the key. Using Menu Option (2), he gives 9 as the response to "Please choose the category that you wish to search on?". In response to "What condition should be applied to UCD Classification?" he would select choice 1 which represents equal to. The computer will respond with "UCD Classification should be = what?" to which he replies 113. The user then responds with "N" to both "Is there an OR condition?" and "Another key?". This is outlined by Table D-4. The search menu choices reappear on the screen and the user would select Menu Option (3) to perform the search. The computer will then start searching the records. When the first match is made or no matches result the computer will ask the user if he wants the output sent to the screen or printer, and if printer, condensed or formatted form. Upon the proper responses the output will be generated in order of records matching and then a waste summary. This example appears below and in Tables D-5 and D-6.

TABLE D-4

SAMPLE OF KEY SELECTION

```
What is the category that you wish to search on? (1-51) 9
Category : UCD Classification
Do you wish to view the range of possible values? (y/n) n

      What condition should be applied to UCD Classification?
            1) Equal to
            2) Not equal to
            3) Less then.
            4) Greater then.

          Choice? (1,2,3 or 4) 1

    UCD Classification should be =  what? 113

     Is there an -OR- condition? (Y/N) n

     Another Key? (Y/N) n
```

TABLE D-5

FIRST PAGE OF SEARCH ON UCD = 113

SURVE1.DAT 03-09-1984

I.C.	# EMP	SIC	UCD	REGION	WS	MAIN COMPONENTS	QUANTITY	UNITS	INTERVIEWER
99	200	2821	113	31	10	45	6000	2	R.R.
147	23	2842	113	39	3	45 52 104	.25	1	G.F.
149	450	2869	113	6	5	153 36 136 25 45	10000	2	R.S.
149	450	2869	113	6	6	136 52 90	.7	6	R.S.
175	3	2899	113	34	2	77 52	50000	2	S.N.
178	151	2911	113	25	3	45 74 58	.8	6	S.N.
263	22	3452	113	39	3	150 71 51	500	2	S.N.
377	267	3534	113	15	5		200	2	F.G.
453	175	3679	113	20	5	45 142	1200	2	G.F.

TABLE D-6

SUMMARY REPORT FOR SEARCH ON UCD = 113

Search Summary 03-09-1984

Search on UCD Classification = 113

Total Records Matching : 9
Records with no waste : 0

Waste Quantities Present :	Units	Present	Future
	Igal/yr	: 1,567,900.0	1,767,700.0
	Tonnes/yr	: 0.2	0.3
	yd^3/yr	: 0.0	0.0
	Other	: 0.0	0.0
Quantities Total	:Tonnes/yr	7,111.	8,017.

A second more complex example would be to search for UCD Classification 281 or 282 with oil and grease as a main component and disposal on-site. In order to do this, the user would first need the numeric codes for the search categories, 9 for UCD Classification, 34 for disposal location, and 18 for main component. Note choice 18 for main component will cause an automatic check of all five main component classifications for the chosen condition. Next he would select Menu Option (2) to pick the keys. The operator would then set the UCD Classifications making sure to insert the OR between the two conditions. Now, he can select the main component to search on. After choosing 18 as the category, he could then view all the possible values by responding YES to "Do you wish to view the range of possible values?". Oil and Grease are listed as numeric code 51. The condition is then set equal to 51. The disposal location code is chosen in a similar fashion. After the keys are all selected, the viewer can view his selection including the nested OR conditions by selecting choice 4. The search can then be performed and an output of the example appears as Table D-7.

By following the simple menu options, a nontechnical user can perform all of the above functions.

The program, while presently complete, may be subject to future enhancements or changes by CANVIRO OR OWMC.

TABLE D-7

SAMPLE OUTPUT FROM A COMPLEX SEARCH

SURVE1.DAT 03-09-1984

I.C.	# EMP	SIC	UCD	REGION	WS	MAIN COMPONENTS	QUANTITY	UNITS	INTERVIEWER
21	85	2253	281	28	1	51	3	2	J.P.
39	47	2421	281	48	1	51	2400	2	G.Z.
43	100	2449	281	46	1	51	50	2	H.M.
45	25	2452	281	48	1	51	95	2	G.Z.
102	11	2821	281	41	3	51	200	2	S.N.
109	893	2824	281	19	5	51	200	2	S.N.
178	151	2911	281	25	5	51	8176	2	S.N.
183	16	3069	281	22	1	51 67 84	90	2	J.P.
188	50	3041	281	24	1	51	45	2	J.P.
201	100	3144	281	39	3	51	5	2	G.Z.
215	50	3295	281	15	1	51	3500	2	S.N.
233	100	3321	281	18	2	51	30	2	H.M.
249	30	3341	281	39	1	51 36	30	2	R.S.
257	80	3321	281	26	2	51 36	45	2	R.S.
274	100	3535	281	3	3	51	660	2	S.N.
313	80	3444	281	43	4	51	60	2	H.M.
320	6	3452	281	24	1	51 36	150	2	M.J.